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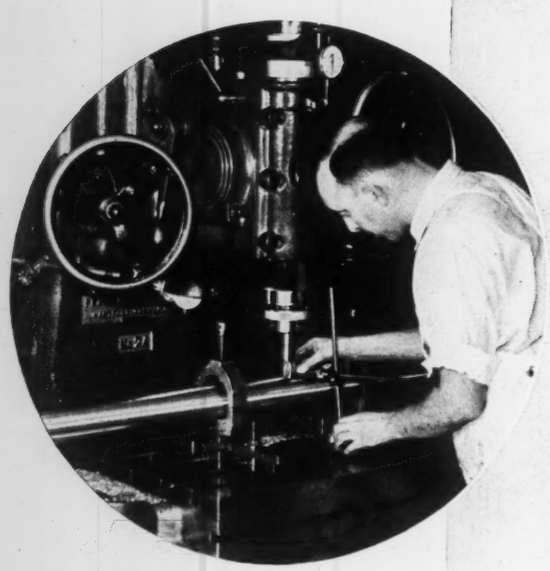
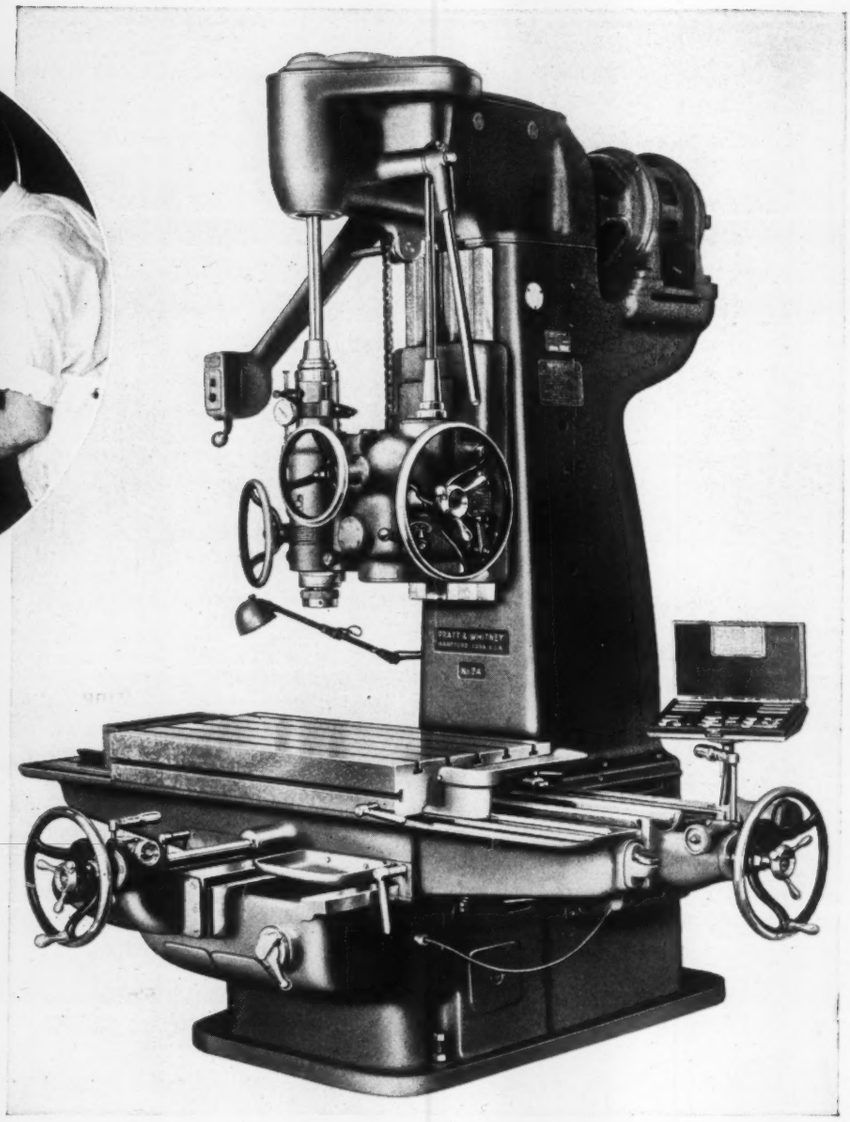


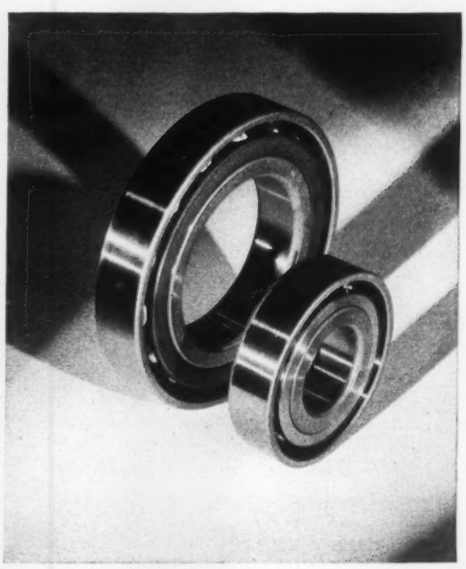


Precision-Built describes its bearings, too!

● The high speeds, extreme accuracy and fine quality of workmanship for which the Pratt & Whitney Jig Borer is built, may be achieved only through insistence on precision manufacture at every step. That also is true of the 28 New Departure ball bearings used in the model 2-A above, including the ultra-precision bearings on the main spindle. Where great accuracy must not only be secured, but *retained* throughout years of service, New Departure forged steel precision ball bearings are increasingly the choice of builders of fine machines.

New Departure, Division of General Motors, Bristol, Connecticut.

2832



NEW DEPARTURE

THE FORGED STEEL BEARING

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CLASSIFIED FOR CONVENIENCE WHEN STUDYING SPECIFIC DESIGN PROBLEMS

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The world's toughest job . . . keeping a rail joint tight! A mere temporary "biting hold" on the nut is wholly inadequate.

From the toughest jobs to the lightest assemblies, maintaining adequate pressures on bolt and nut thread surfaces is the one and *only* means which will *keep* bolted parts tight. So-called locking devices, having only a *temporary biting* hold to prevent backward nut movement, are useless. They cannot *compensate* for *initial causes* of looseness: bolt stretch; wear of contacting surfaces; breakdown of rust, scale or paint. That function is *exclusive* in Helical Spring Washers. "Only a Spring Washer has *long range* Live Action!" The fact that Spring Washers are selected for the "world's toughest job," is *your* assurance that they are the only safe device for holding bolted assemblies tight. "Better be Safe than Sorry"... specify *Helical Spring Washers.*

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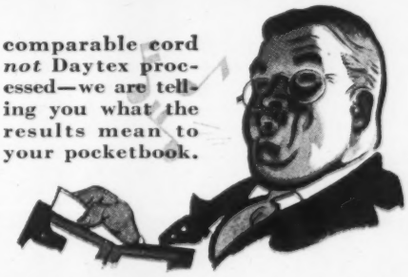
ONLY A HELICAL SPRING WASHER HAS *LIVE ACTION!*

YOUR WAIST MEASUREMENT may be your personal affair but your business *waste*-line is ours.

Our job of reducing your production costs began with the seven years of tireless research which our technical laboratories spent in developing Dayton V-Belts with Daytex Cord in their neutral axis section.

Right now—instead of telling you about the exhaustive laboratory tests which proved beyond question that Daytex Cord has less stretch, longer life and greater strength than the best comparable cord *not* Daytex processed—we are telling you what the results mean to your pocketbook.

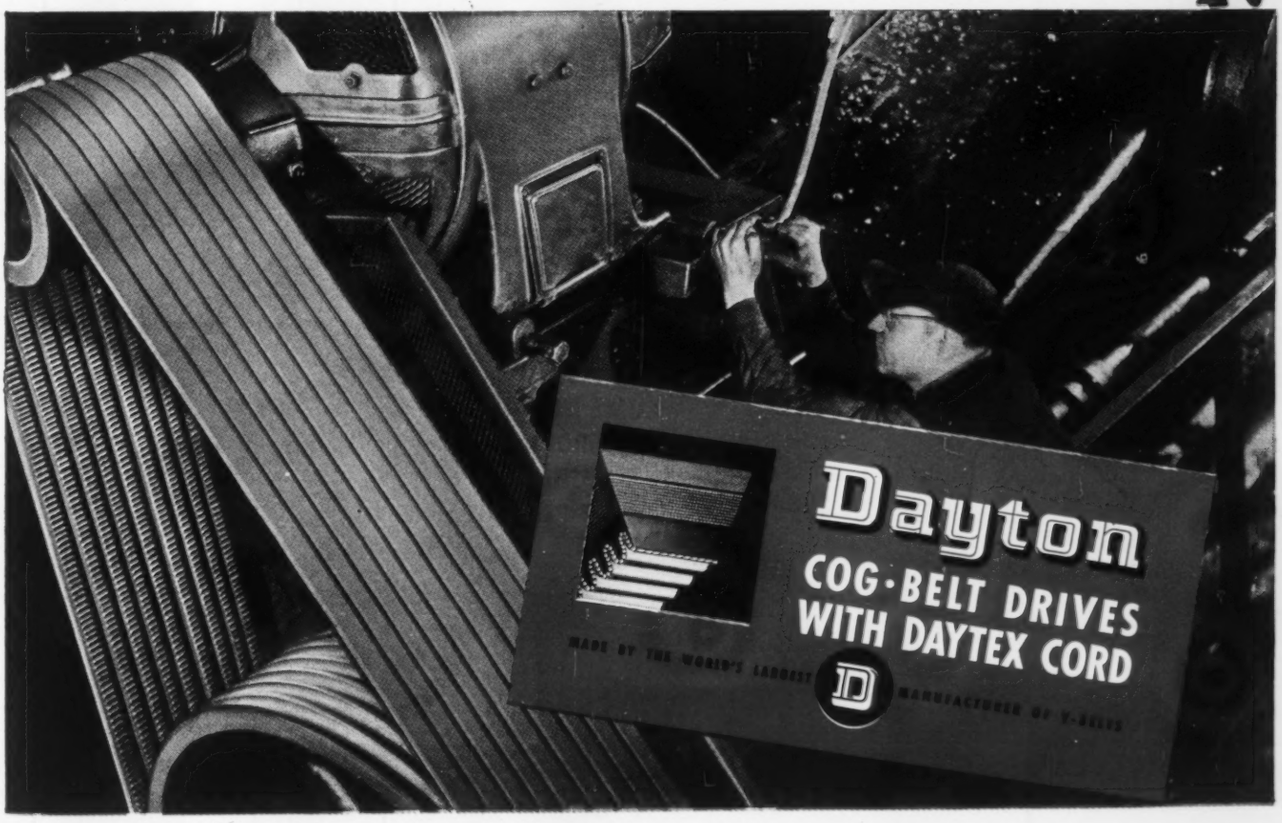


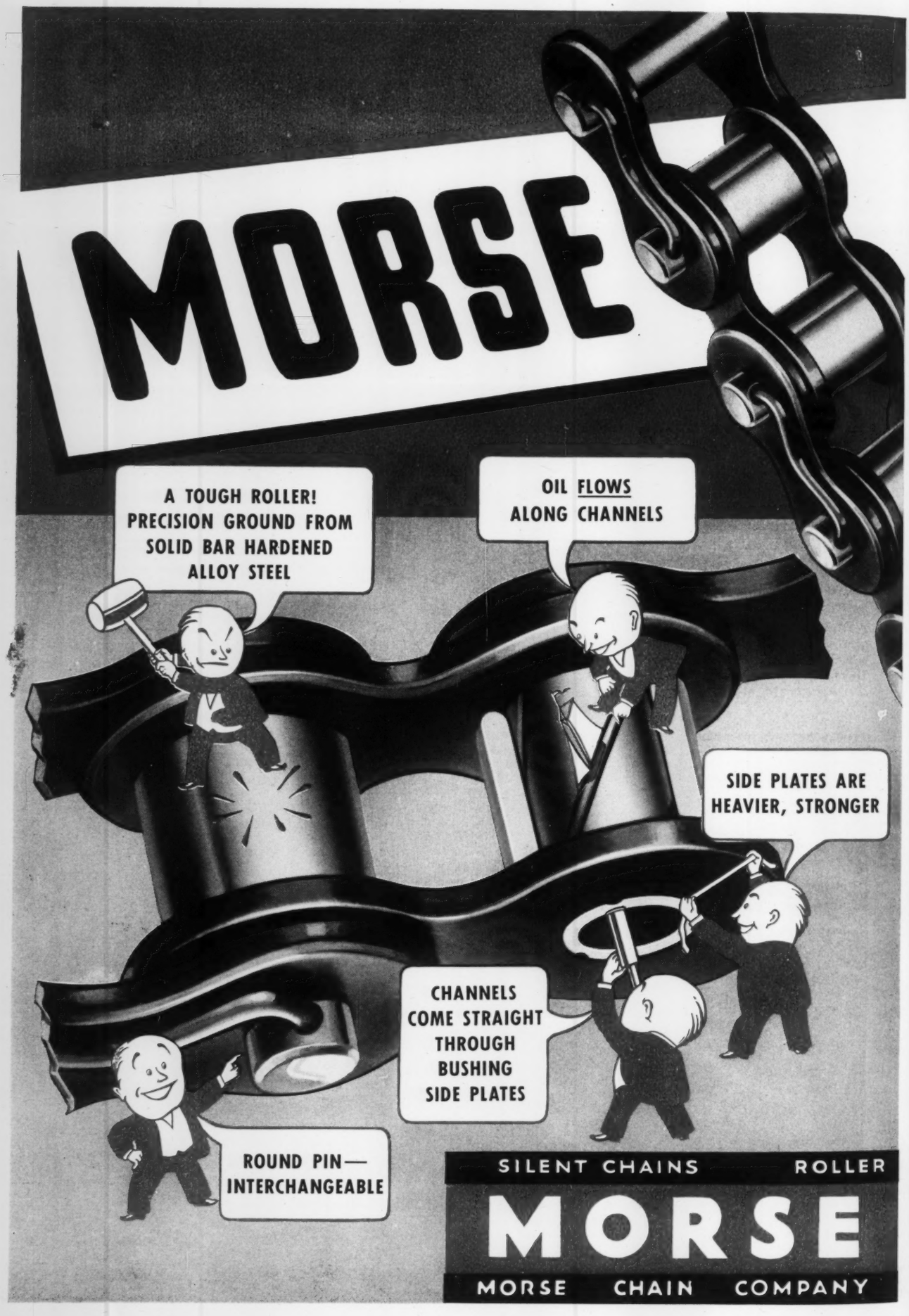
Field applications, under all conditions, in all types of industries, in all climates and places, prove beyond question that Dayton V-Belts with Daytex Cord are cooler running and stand up under constant high speed flexing to give you greater pulling power at less cost per day, per month or per year.

Dayton V-Belts are outstanding in basic design because they are built to bend with patented cog construction. They work on short centers and save space. They reduce adjustments to a negligible minimum. They increase output, they reduce expense, maintain machine speed and prevent power waste.

In other words Dayton V-Belts with Daytex Cord save your time, your money and your machinery. Get all the facts from your local Dayton distributor. Ask him for catalogs, data and "The Picture Story of Daytex Cord."

THE DAYTON RUBBER MANUFACTURING CO.
DAYTON, OHIO




MORSE
A TOUGH ROLLER! PRECISION GROUND FROM SOLID BAR HARDENED ALLOY STEEL
OIL FLOWS ALONG CHANNELS
SIDE PLATES ARE HEAVIER, STRONGER
CHANNELS COME STRAIGHT THROUGH BUSHING SIDE PLATES
ROUND PIN— INTERCHANGEABLE
SILENT CHAINS ROLLER
MORSE
MORSE CHAIN COMPANY

Roller Chain

. . . interchangeable, channel lubricated . . . GREATEST ROLLER CHAIN ADVANCE IN A DECADE

NOW . . . Morse Roller Chain. A chain with a built-in lubrication system in every link, and which is completely interchangeable with every other standard roller chain. It's just what the engineers ordered.

The Morse Roller Chain puts the protection of assured lubrication right where it is most needed—and where conventionally designed roller chains most often fail—on the bearing surface of pins and bushings. Oil on the rollers of the Morse Roller Chain quickly finds its way to the spaced channels on the bushing face, flows through the side plates and down to the pin, where capillary action takes charge and spreads a protective film over the whole pin surface.

Positive lubrication makes for longer life. Here are other features which mean economical, trouble-free operation: huskier side plates mean tighter pins and bushings, making Morse Roller Chains comparable in strength to "heavy series" in other types; rollers are ground from solid bar hardened alloy steel; Morse patented spring cotter, available at no extra cost, is fast against all vibration and will not chew.

Let the Morse man in your territory tell you all about Morse Roller Chains —or write direct to Morse, Ithaca.

Interchangeable with all Standard Roller Chains

THE PIN LINK

OFFSET LINK
for chains with uneven number of links

THE BUSHING LINK

CHAINS FLEXIBLE COUPLINGS KELPO CLUTCHES

Roller CHAINS

ITHACA N. Y. DIVISION OF BORG-WARNER CORP.

SEMS* WIN

PRE-ASSEMBLED SHAKEPROOF LOCK WASHER AND SCREW

Can't COME OFF!

Also available with PHILLIPS Recessed Heads

*SEMS is the registered trade-mark of Illinois Tool Works, manufacturers of Shakeproof Lock Washers. Only Shakeproof Lock Washers are used in the manufacture of SEMS Fastening Units.

FREE SAMPLE KIT!

SEMS Fastening Unit is one of many Shakeproof Products which have been developed to improve performance and reduce assembly costs in metal working industries. The kit illustrated at the left, which contains samples of Shakeproof Products, is sent free on request. Write for yours today!

SEMS Fastening Unit with Countersunk Type Lock Washer

SEMS Fastening Unit with Internal Type Lock Washer

SHAKEPROOF LOCK WASHER CO.

Distributor of Shakeproof Products Manufactured by Illinois Tool Works

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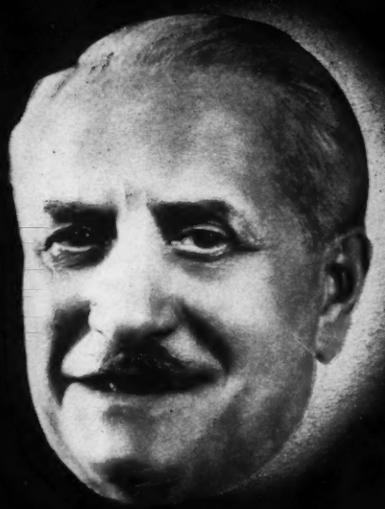
INVESTIGATE THESE TIME AND MONEY SAVING ADVANTAGES!

Delivered as One Unit | Save Valuable Production Time | No Lost Lock Washers | No Screw Driven Without Lock Washer | Every Screw Locked Tight

N UNANIMOUS APPROVAL!

DEFINITE ADVANTAGES FOR EVERY DEPARTMENT

When I specify SEMS Fastening Units I know that every screw on our product will be driven with the correct size and type of lock washer to keep it tight under any degree of vibration. This means the customer will enjoy the original performance designed into our product, and costly complaints will be kept at a minimum.



DESIGNING ENGINEER

PRODUCTION MANAGER

Here's a fastening method that solves many production worries. SEMS units eliminate the expense of lost and wasted lock washers. They also save the time formerly spent putting lock washers on screws. They are easier to handle in fastening hard-to-reach parts and can even be used with automatic hopper feeds.

PURCHASING AGENT

SEMS Fastening Units save money—and they start doing so right in our ordering department. One order, one receiving report, one invoice for both products—where two were previously required. And—they simplify stockroom work, too. Less storage space is needed and inventories are kept perfectly balanced because both products are delivered as one unit.

"Fastening

SHAKEPROOF

Headquarters"

SEMS Fastening Units . . . Lock Washers
Locking and Plain Terminals

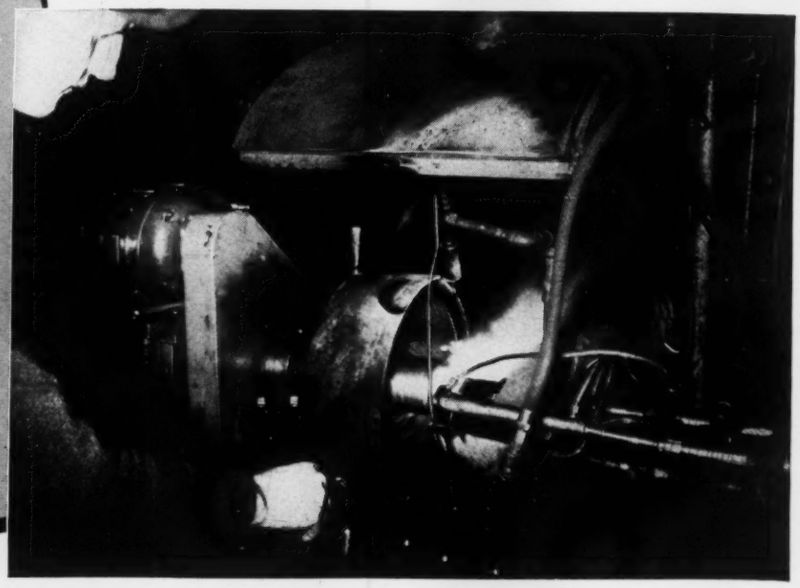
Thread-Cutting Screws . . . . Locking Screws
Spring Washers . . . . Special Stampings

WHEEL HUBS HARDENED THE AIRCO WAY

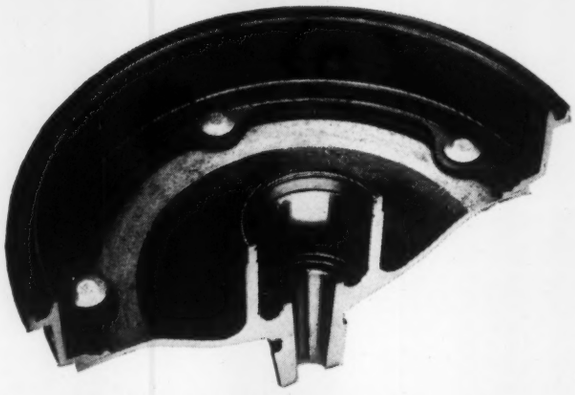
★ have fewer parts

★ weigh less

★ reduce manufacturing costs



THE OLD type hub, showing hardened steel sleeve, inserted to protect vital wearing surface.



THE NEW type hub, Airco Flame-Hardened, an integral protective surface, requiring no inserted outside raceway.

The wearing surfaces of wheel hubs can now be flame-hardened . . . inserted outside raceways need no longer be used. Flame-hardened wheels require less material . . . have fewer parts . . . weigh less. These advantages are obtained while effecting worthwhile savings in manufacturing costs.

The Airco Flame-Hardening Process is the modern way to harden wearing surfaces while retaining the desired physical properties of the core metal. Airco's Applied Engineering Department will be glad to assist Airco customers solve problems involving surface wear. Write for details.

AIR REDUCTION

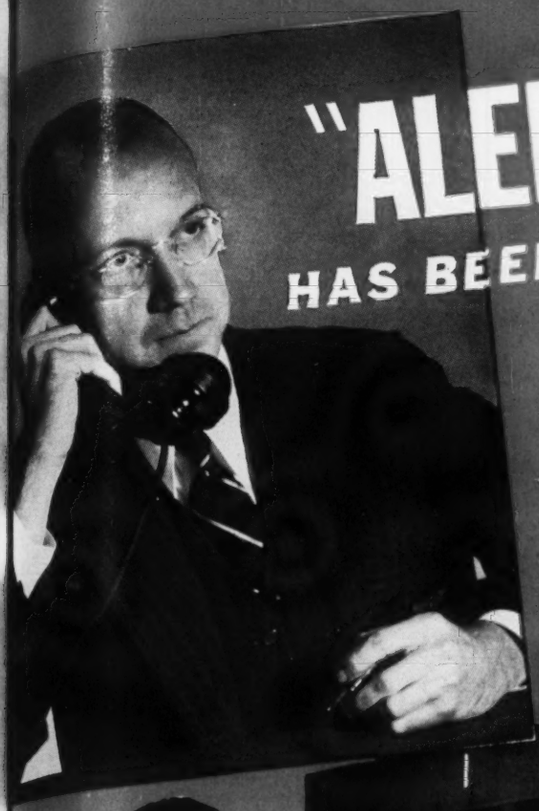
SALES COMPANY

General Offices: **60 EAST 42nd ST., NEW YORK, N. Y., DISTRICT OFFICES IN PRINCIPAL CITIES**

AIRCO *Anything and Everything for* **GAS WELDING or CUTTING and ARC WELDING** WILSON

"ALEMITE LUBRICATION HAS BEEN STANDARD ON OUR MACHINES FOR OVER 15 YEARS!"

F. K. SIMMONS, *President*
The Henry & Wright Manufacturing Co.

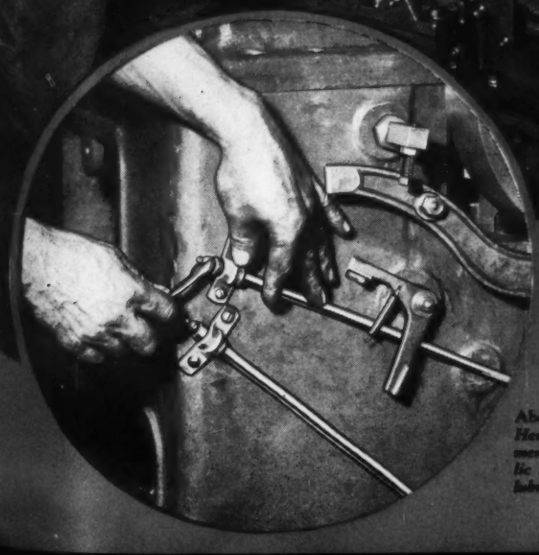


Insures Positive, Dependable Lubrication— Cuts Maintenance Costs, Says Manufacturer

"Alemite Fittings have been used as standard equipment on our standard dicing machines and steel presses of 50 tons and greater capacity for the past 15 years. We have found the Alemite System highly satisfactory. Alemite No. 33 Lubricant is used to lubricate our machines prior to shipment."

THUS writes the president of The Henry & Wright Mfg. Co., Hartford, Conn., Mr. F. K. Simmons. And he goes on to say that machines so lubricated give *better performance,* require *less service* from the manufacturer and *less maintenance expense* on the part of the user. Previous to the adoption of Alemite Lubrication, these machines sometimes required oiling *four times a day;* now Alemite *twice a day* keeps them operating perfectly.

The use of Alemite Guns and Alemite Fittings is saving millions of dollars yearly for industry! Write for our latest catalog, *"Alemite Industrial Lubrication Equipment."* And feel free to ask Alemite engineers for their recommendations —no obligation!

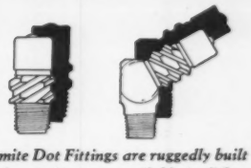


Above: Lubricating eccentric block on Henry & Wright machine prior to shipment. Below: Installing Alemite Hydraulic Fittings on pipe extensions for safe lubrication while machine is in operation.

ALEMITE
REG. U. S. PAT. OFF.

A Division of Stewart-Warner Corporation,
1804 Diversey Parkway, Chicago, Illinois
and
The Stewart-Warner-Alemite Corporation of Canada, Ltd., Belleville, Ontario

WORLD'S LARGEST MANUFACTURER OF LUBRICATION PRODUCTS



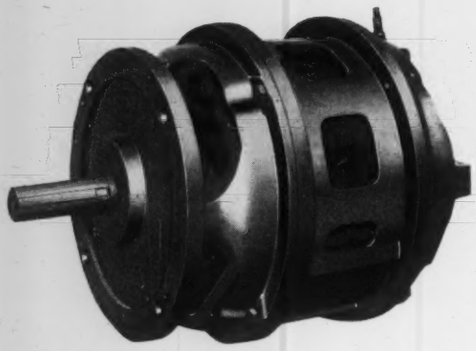
Alemite Dot Fittings are ruggedly built for heavy duty use; available in different angles and thread sizes; heavily cadmium plated.

Alemite Button Head Fittings are designed for bearings requiring a volume of lubricant, such as heavy machines and contractors' equipment.

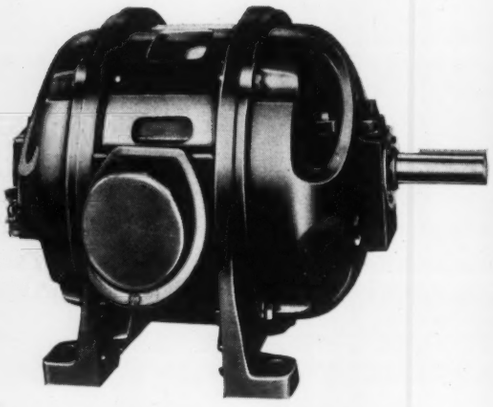
Alemite Hydraulic Fittings, world's most popular lubrication fitting for most industrial and automotive requirements; can't leak under pressure.

Alemite Flush Type Fittings meet need where lack of clearance prohibits use of protruding fittings.

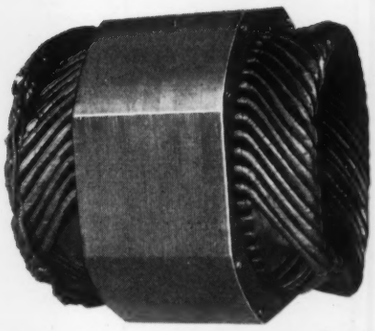
"SPECIAL" DESIGNS WITH "STOCK" DRIVES



Type B Flange Mounting . . . rigid one-piece frame supports the motor.

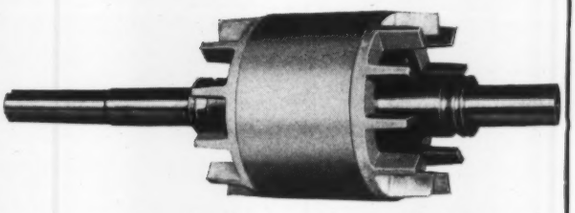


Standard one-piece frame gives extra mechanical strength at no extra cost. Electrical parts are free from mechanical strain from bearings and shaft.



Standard pre-wound stator core is independent of supporting frame . . . fits standard frame or built-in applications.

WESTINGHOUSE STANDARD DRIVES AND INTERCHANGEABLE ASSEMBLIES SOLVE MANY SPECIAL DESIGN PROBLEMS



Standard rotor construction . . . indestructible die-cast aluminum.

NEW MANUAL STARTER TAKES LESS SPACE

An economical starter that is especially designed for mounting on machine or motor in minimum space. For motors up to 7½ hp. Keeps motor control within arm's length of the operator.

"DE-ION" MOTOR WATCHMAN

COMPLETE CONTROL IN ONE PACKAGE

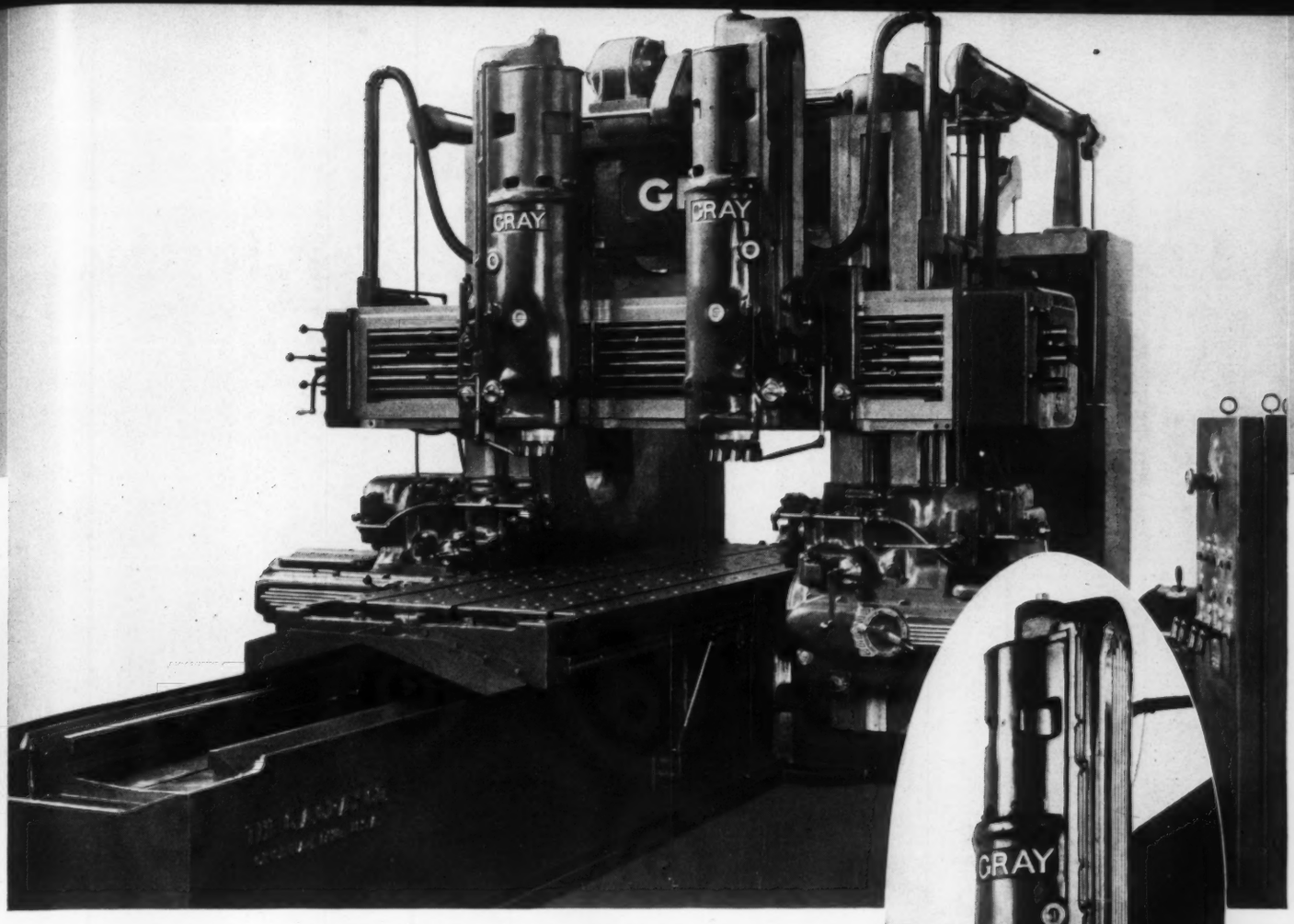
One unit provides all needed devices in the motor circuit:

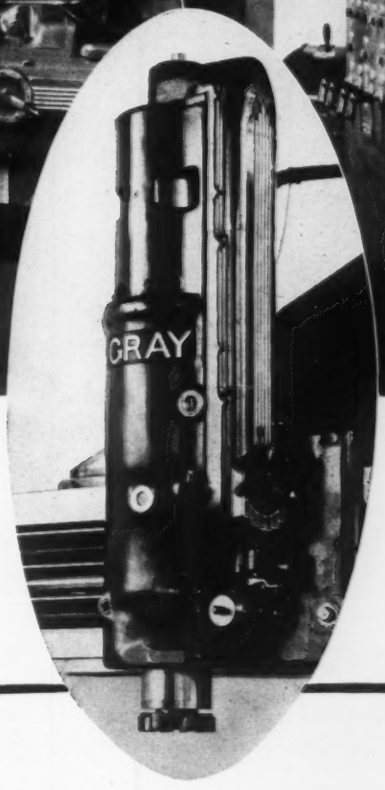
1. Magnetic starter
2. Motor overload protection
3. Manual disconnect switch
4. Fuseless circuit protection

COMBINATION LINESTARTER

Westinghouse

W WESTINGHOUSE ELECTRIC





18 SPINDLE SPEEDS ON THE NEW GRAY MACHINE OBTAINED WITH STANDARD WESTINGHOUSE MOTORS AND CONTROL

Designers of the new Gray Planer Type Milling Machine wanted *push-button control,* wide flexibility and maximum rigidity.

All three are accomplished in the most economical manner by the use of 9 individual Westinghouse motors, giving finger-tip control and maximum flexibility. And the substitution of these individual drives for long drive shafts results in greatest possible rigidity.

The machine is an outstanding example of how Westinghouse can meet special requirements from stock motors and controls.

Our engineers are at your service in similar drive problems. Call the local office, or write Westinghouse Electric & Manufacturing Company.

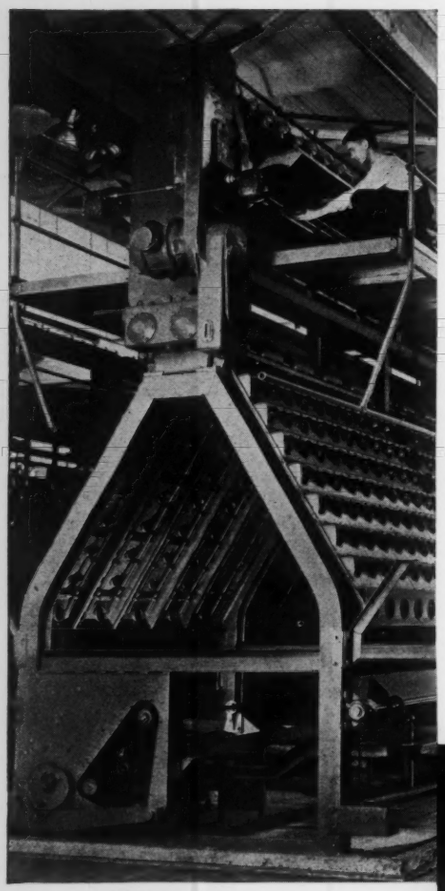
J-90189

Westinghouse Standardized Drives on this machine include:

4 — 10 hp 900 to 1800 rpm spindle drives, 2 speeds.
1 — elevating motor.
1 — table feed gearmotor.
1 — table traverse motor (high speed).
1 — lubricating pump motor.
1 — coolant pump motor.

Motors and Control

All-Welded, Rolled Steel Construction Makes *Miracle Machine* Possible!



Set-up of the all-welded structural frames for the continuous spinning process machine units—operator's walkway at the process panel level not yet installed, but its supporting brackets are in place. Each unit has an individual motor drive and is composed of 5 intermediate A-frames, one end-drive A-frame with machinery box, 10 process panels, spin frames, spin transmission beams, machinery brackets and various other miscellaneous structural parts.

Here's the heart of the newest, most revolutionary production cycle the viscose rayon industry has seen in years. A close-up view of the stepped process panel showing pressed steel cups welded to the inclined skin plate. These cups, counterbored to a tolerance of .001 inch diametrically and held to a close vertical alignment and parallelism, act as retainers for flanged bearings supporting the process reels. Accuracy, rigidity and perfect alignment of the hundreds of moving parts on the panel were obtained through an unusual job of jig welding.

Sets new standards of precision . . . at approximately half the cost of previous methods of construction

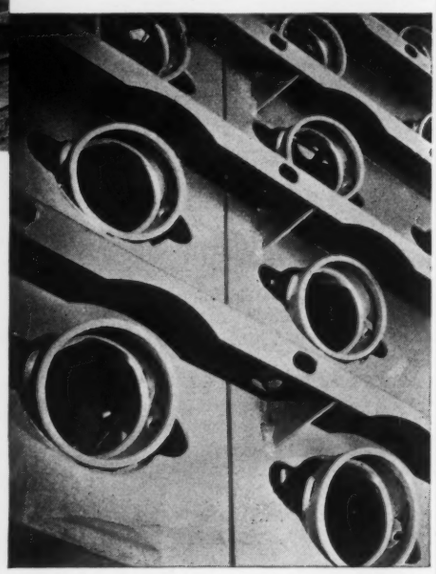
THEY said it couldn't be done. But here it is! The world's first commercial installation for the continuous spinning, processing, drying and twisting of viscose rayon yarn in one machine. 96 of these machines were installed in the new Painesville, Ohio, Plant of the Industrial Rayon Corporation. They will eliminate handling and interruptions, and produce a higher quality, uniform yarn more economically than ever before.

And all-welded construction with U·S·S Rolled Steel made it economically possible! Rolled steel construction effected a large reduction in weight . . . and a clean-cut structure devoid of complicating details and multiplicity of small parts.

The structural steel frames for these machines were fabricated by American Bridge Company. Each of the 96 units is 10 ft. 1 in. wide, 45 ft. 1 in. long and about 19 ft. high. Not merely the quantity involved, but the extreme accuracy required to assure perfect alignment needed constituted a problem which was economically solved by a resourceful, efficient combination of welding and U·S·S rolled shapes.

This revolutionary use of rolled steel construction opens a new realm of possibility for the fabrication and design of industrial equipment. From the experience gained on this contract, it is believed that many types of machine frames and supports, hitherto thought impractical to fabricate by welding, may now be undertaken with confidence.

We offer special steels in widest range. And our experience in putting these steels to work is yours for the asking. Investigate the economies, the added life, the strength, and speed of fabrication that rolled steels can give to equipment you fabricate.



Here are a few of the variety of special steels with special properties to overcome destructive forces in your rolled steel construction:

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to carry high unit stresses and to reduce weight to a minimum at low cost.

U·S·S ABRASION RESISTING STEELS
to reduce wear and cut replacements.

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to carry tremendous bearing pressures.

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to endure high temperatures that spell disaster to other metals.

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to resist corrosive environments, to assure long life. Special analyses can be welded with no loss in corrosion resistance.

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UNITED STATES STEEL

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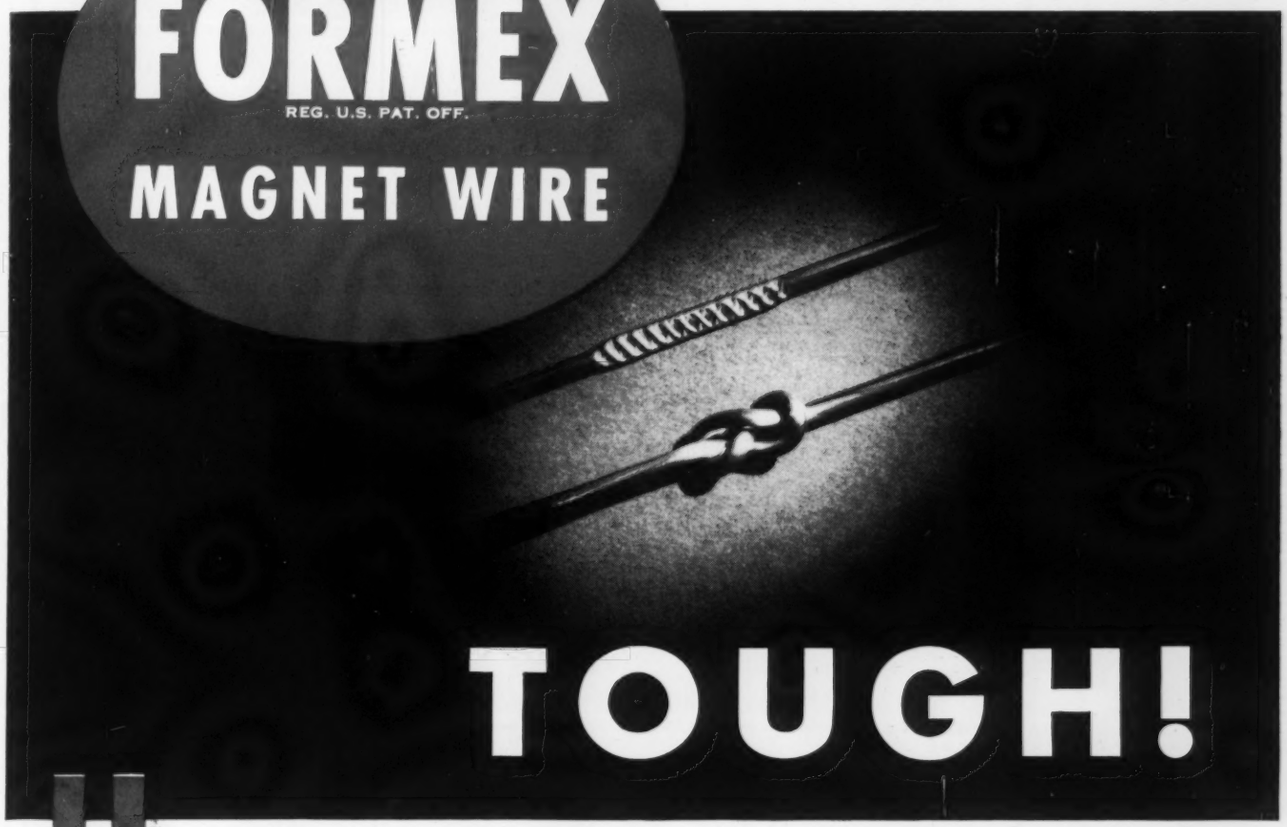
MAGNET WIRE



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HIGHER WINDING SPEEDS---
FEWER REJECTS---LOWER COSTS

YOU'D never abuse wire by stamping it in a die or twisting it in a knot. But these simple tests illustrate the resistance of Formex wire to the rough usage encountered in high-speed-winding and assembly operations. The result is sizable savings.

Actually, the real savings begin earlier. In first cost, for example. As compared with single cotton enameled in most sizes, Formex wire is priced less per pound, and you always get more feet in a pound. It also takes up less coil space, and thus saves copper.

When you consider its other properties, too—such as resistance to stretch and to heat aging, high dielectric strength, and low dielectric losses—you can see why Formex wire has upset all existing magnet-wire standards. It's new, and it means change—opportunities for making profitable improvements in design.

For details, see Bulletin GEA-2973. Also ask for samples. Address nearest G-E sales office or General Electric, Dept. 6B-201, Schenectady, N. Y.

FORMEX WIRE IS A PRODUCT OF GENERAL ELECTRIC RESEARCH

GENERAL ELECTRIC MAGNET WIRE

ALWAYS THE RIGHT TYPE FOR EACH JOB

GENERAL ELECTRIC

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IN THE GREAT PLASTICS INDUSTRY (as an example), hydraulic controls must do a real man-sized job. For years Vickers pumps and hydraulic controls have been used as standard equipment on most of the leading makes of injection molding machines—and millions of plastics products have been quietly and efficiently produced with the Vickers Hydromotive Power developed.

This is but one example of the gruelling day-in and day-out service expected of Vickers equipment. Massive hydraulic presses, light, fast, automatic machines, hard-working machine tools of every kind—they all rely on Vickers controls for their Hydromotive Power.

Your power application and control problem can be solved hydraulically—ask Vickers.

VICKERS *Incorporated*

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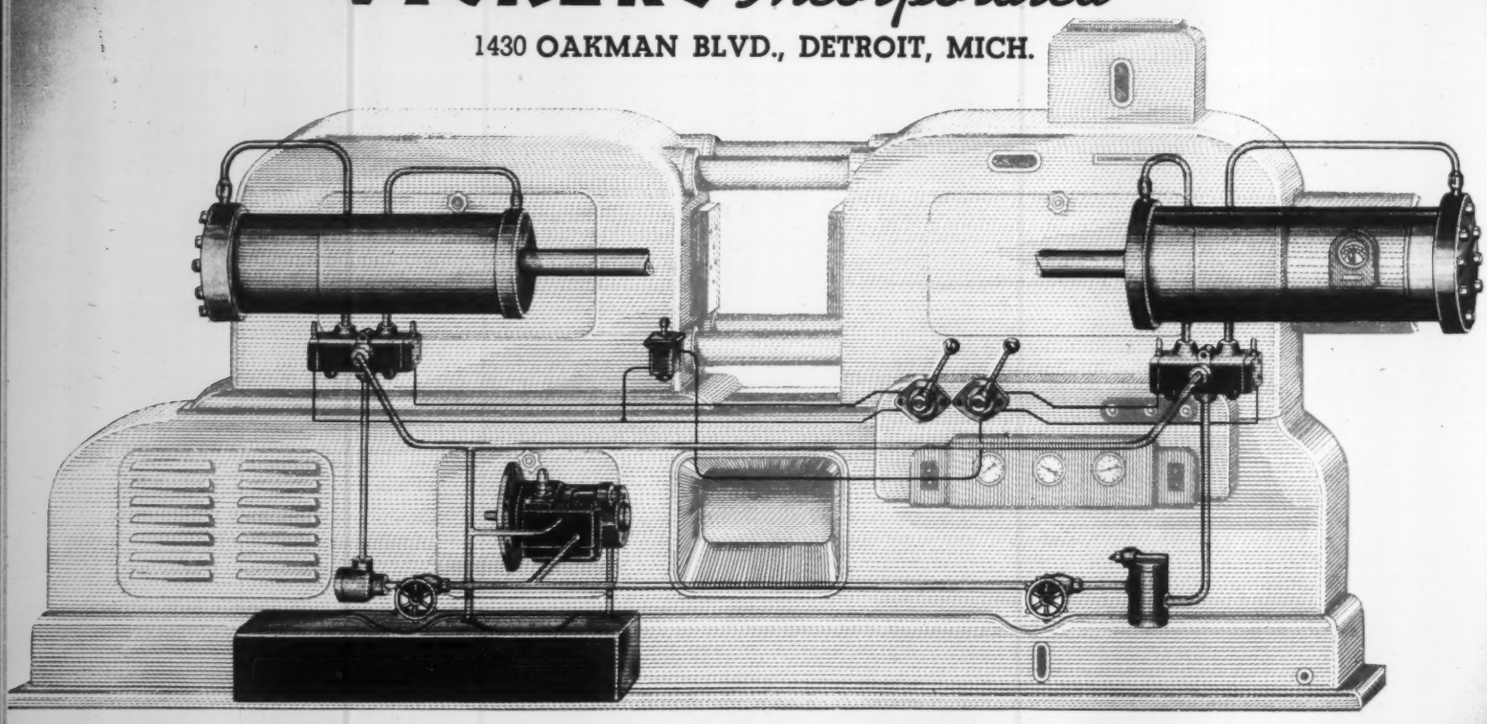
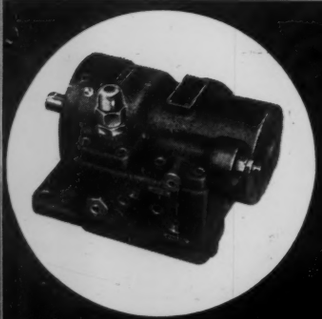
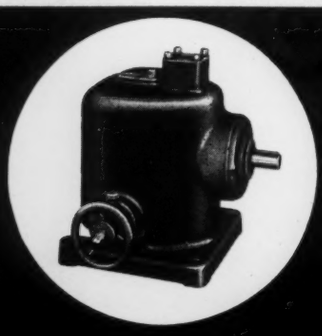
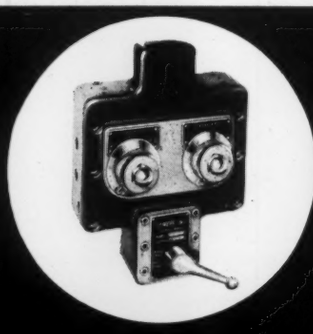




Vickers Double Pump and Combination Valve Unit has quiet operation and pressures to 1000 lbs. per sq. in. for continuous duty.



Vickers Variable Delivery Pump has multiple piston variable displacement construction of new and improved design.



Vickers Electric-Hydraulic "Traverse & Feed" Panels are available in several types and sizes.

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No matter what your fluid is — nor how much of it there is — Cuno can strain it. Continuous protection. No duplex installations. No shutdowns for cleaning. The Cuno cleans itself: small ones with a flick of your wrist, big ones with a motor. The losses that used to pile up from old fashioned stop and go straining are gone.

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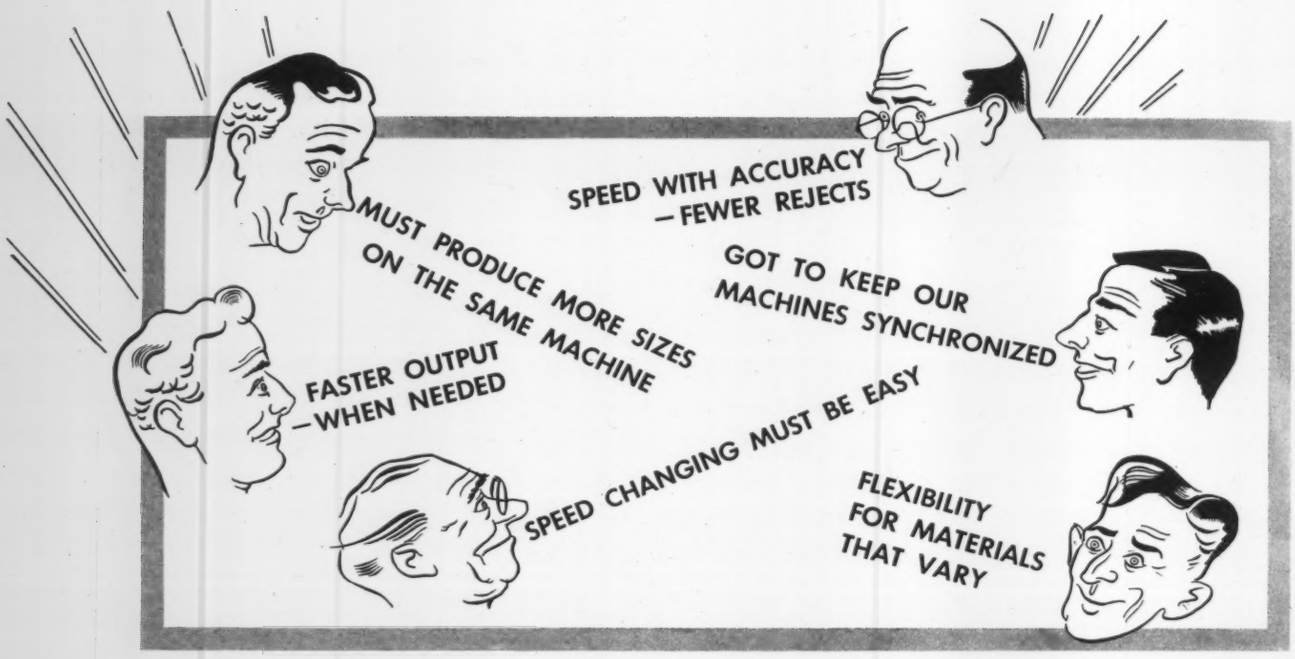


ARE BUYERS OF PRODUCTION MACHINES *Asking Too Much?*

Builders of 1328 Different Machines Don't Think So—and Standardly Provide Accurate REEVES Speed Control

● In the final analysis, it is *what a machine will do*, that determines how it will sell. Even when it is purchased to turn out a certain standardized product, variations are constantly occurring in materials, skill of operators, and required volume of production.

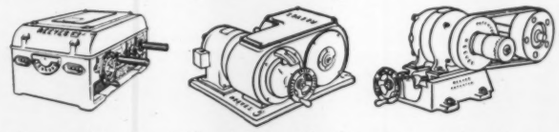
But rarely indeed is the operation of any machine so definitely fixed. Owners want to make different items out of different materials. They want to speed up or slow down production to meet all sorts of conditions in materials and in quality and quantity of work, all requiring *different speeds* for desired results.

Why not equip *your* machines so your customers can operate them *at any speed they need?* There's a REEVES Speed Control unit which you can incorporate in your machine with little or no change in design or manufacturing. The cost will be considerably less than you would expect, and your customers will have all the advantages of proved dependability.

No other speed control manufacturer is so well equipped to serve you—no other has such a wide range of units, sizes, mountings, and controls to choose from, and no other has had such long, and practical experience in adapting these units to different types of machines. REEVES Speed Control is infinitely adjustable, accurate, and positive. It builds sales and good will for any machine to which it is applied. Send for new catalog G-397 which describes REEVES Speed Control and its use as standard equipment by builders of 1328 different machines.

REEVES PULLEY COMPANY, DEPT. H, COLUMBUS, INDIANA

THE 3 BASIC REEVES UNITS



The complete REEVES line is the result of many years of continuous development in which three basic units, with adaptations meet all requirements. *Left*, The REEVES VARIABLE SPEED TRANSMISSION provides maximum accuracy and adjustability over a wide range. Made in open and enclosed, vertical and horizontal units. Thirteen sizes—fractional to 75 h.p. Speed Variations 2:1 to 16:1 inclusive. *Center*, VARI-SPEED MOTODRIVE, includes motor, speed varying mechanism and reduction gears (where required) in one compact unit. Five sizes, horizontal and vertical types, ¼ to 10 h.p. Speed variations 2:1 to 6:1 inclusive. *Right*, VARI-SPEED MOTOR PULLEY, simplified development of transmission. Mounts on standard shaft of any constant speed motor and forms direct drive to machine. Ten sizes, fractional to 15 h.p.; 3:1 range of variations.

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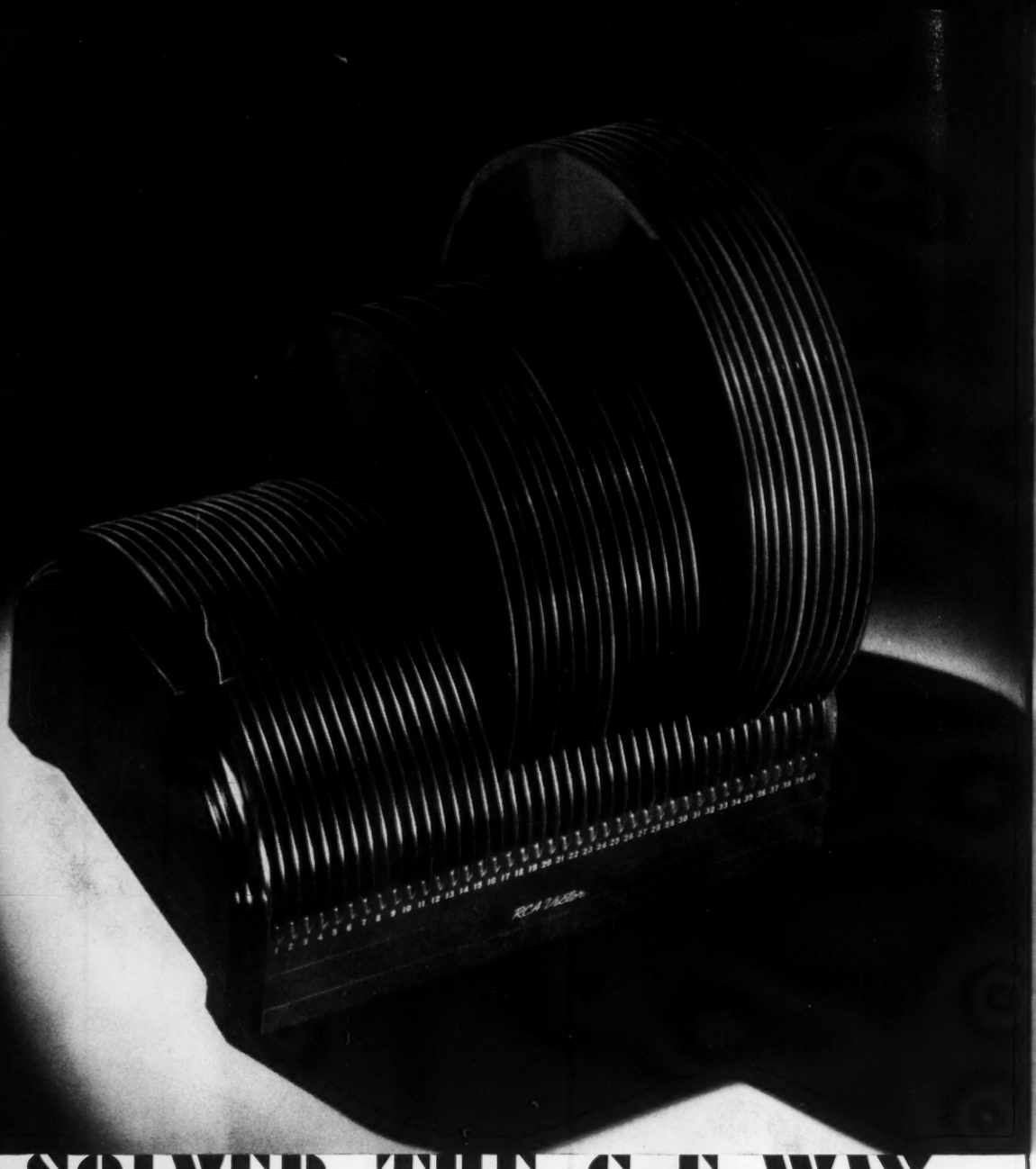

SOLVED THE G-E WAY

PART: Textolite molded rack. **USE OF PART:** Used as a holder for Victor and Bluebird records manufactured by the RCA Mfg. Co., Inc., Camden, N. J. **CUSTOMER'S PROBLEM:** The selection of a material that would permit construction of this design and provide smooth, nonscratching surfaces with good appearance. **SOLVED THE G-E WAY:** Plastics was the most practical and economical material to use. It became a matter of applying General Electric's years of molding experience and putting into use its many facilities to make the holder acceptable. General Electric's contribution was fivefold. First, the mold construction was difficult because of its size and the intricacy of the thirty-nine curved record spacers placed every 5/16 of an inch apart. The spacer grooves had to be machined out of solid steel blocks to eliminate parting lines and thus assure smooth surfaces in the finished part. Second, by suggesting a change in design, the weight was reduced with no sacrifice of strength and an appreciable saving of compound was effected. Third, a method of controlling warpage due to the narrow curved spacers was devised and successfully put into effect. Fourth, a new and inexpensive way of printing was developed for the numbers and trademark. Fifth, General Electric suggested means of affixing the bumper plates to the holder, thus helping to reduce the customer's assembly cost. What can THE G-E WAY contribute toward the successful and economical molding of your plastic requirements? Write Section M-129, Plastics Department, General Electric Company, One Plastics Avenue, Pittsfield, Massachusetts.

PD-691A

GENERAL ELECTRIC

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The answer tells why

"VICTOR SEALS OF SECURITY" *pace the industry today*

A watch is able to render dependable, faultless service with split-second accuracy only because each and every part is a precision job of the highest order.

A Victor Oil Seal is a precision job, too. Its parts are not so numerous or so small as watch parts. Tolerances are not so fine. But the service it renders is just as vital *in its place,* as is the correct time to a railroad engineer or a laboratory expert. And among products of its kind it is made with a *precision* that is outstanding.

Victor engineers and craftsmen know that Victor "Seals of Security" perform a service that is *vital.* Failure of such seals would render valuable machinery useless. That is why Victor "Seals of Security" are designed and built to give better sealing service —a better assurance against failure—a longer life.

Victor's accepted position as a *leader* in its industry is due to the high standards of precision craftsmanship maintained in the modern Victor plant. Also to the development of better merchandising, packaging, labeling and cataloging methods. We will gladly discuss any sealing problem with you. Victor Manufacturing & Gasket Co., P. O. Box 1333 . . . 5750 Roosevelt Road, Chicago, Illinois, U. S. A.

VICTOR

GASKETS • OIL SEALS • GREASE RETAINERS

SEALS OF SECURITY

The Victor Buyer's Guide

Rated by users everywhere as an outstanding achievement in cataloging for the Gasket industry. It makes ordering easy and accurate. A great time- and error-saver.

Valve disc and guide cylinder in the 12" toggle-operated non-return Wm. Powell Co. valve shown above are made of "S" Monel, heat treated to 320-350 Brinell. A good example of the special applications for which high Nickel alloys are so well suited. Inset shows details of ground and polished guide liner.

Hard and non-galling, even at 900° F., cast "S" Monel is tops for high temperature service

What metal withstands the gruelling punishment of 1500 lbs. steam pressure and 900°F. temperature? In this high-pressure, non-return valve moving parts are made of "S" Monel. This cast Nickel-base alloy offers exceptional hardness, and so is especially suitable for valve seats, cylinder liners, bushings and similar parts that must resist wear, galling, and corrosion.

Like regular Monel, "S" Monel is a strong, rust proof, corrosion resistant metal. What makes "S" Monel so exceptionally well suited for use in high temperature steam is its special ability to retain *great hardness at high temperature.*

At 1100°F. "S" Monel is almost as hard as at ordinary temperatures. It is also highly resistant to galling. Hence, when used for parts in rubbing contact at high temperatures... where good lubrication is impossible... "S" Monel withstands gruelling heat and wear, and does not seize. Furthermore, since "S" Monel cannot rust, condensate does not roughen its polished surface during shut-down periods.

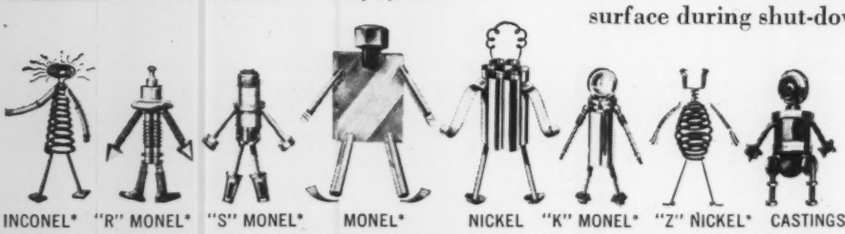
STRONG, TOUGH CASTINGS THAT RESIST CORROSION

For sound, strong castings in Nickel and high Nickel alloys come to casting headquarters... the INCO foundry, Bayonne, N. J. Write for the booklet, "Better Castings from a Modern Foundry."

For further information on "S" Monel write for "Putting the Heat on Valve Materials – II." Ask also for technical data on other Nickel-base alloys.

MONEL

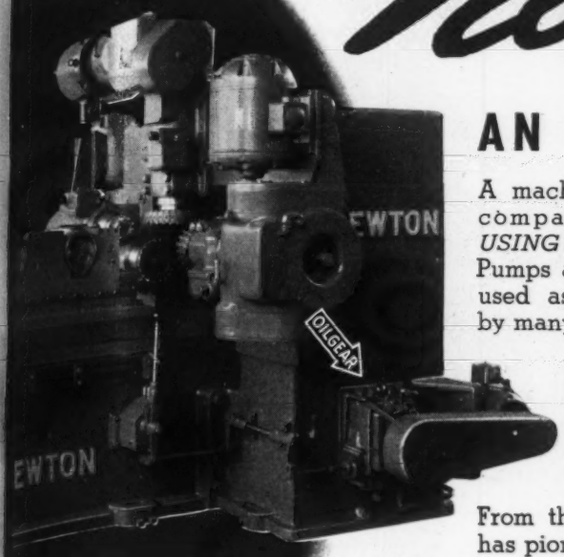
"Monel" and other trade-marks which have an asterisk associated with them are trade-marks of The International Nickel Company, Inc.



INCONEL* "R" MONEL* "S" MONEL* MONEL* NICKEL "K" MONEL* "Z" NICKEL* CASTINGS

THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York, N. Y.

SUCH PREFERENCE FOR OILGEAR IS *Not* AN ACCIDENT

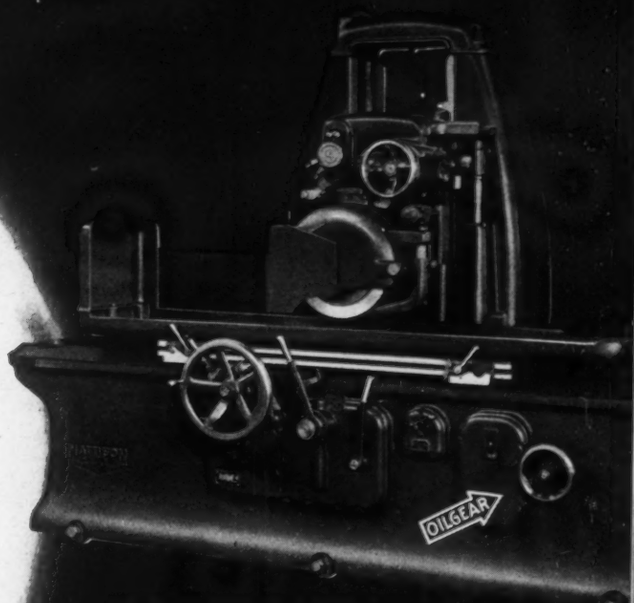


Oilgear powers the feed and rapid traverse of this Newton Straight Line Unit Head Milling Machine. The makers, the Consolidated Machine Tool Corp., have used Oilgear extensively since October 1926.

A machine is known by the companies that *KEEP ON USING IT!* Oilgear Fluid Power Pumps and Motors have been used as standard equipment by many leading machine and machine tool manufacturers for periods ranging from 10 to 17 years. *Such preference must be merited,* as you well know.

From the beginning, Oilgear has pioneered the outstanding advances in fluid power applications. Today, Oilgear pumps and motors are better than ever, simpler, more efficient. They provide safe, cushioned power at operating speeds impossible to secure in any other way. They reduce tool breakage and permit wider latitude in tool and work material. They reduce normally high maintenance, synchronize production, provide exceptional flexibility and precision of control and convenience in operation.

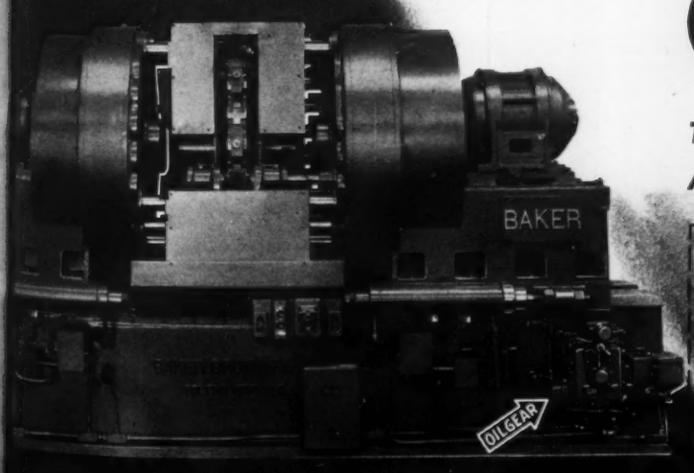
We suggest you get *all* the facts about this *better* fluid power equipment. Send the handy coupon for the 64-page Handbook 47000. Send today. THE OILGEAR COMPANY, 1310 W. Bruce Street, Milwaukee, Wisconsin.



Mattison Machine Works have used Oilgear Feeds since 1928. For their High-powered Precision surface grinder, Oilgear provides steplessly variable table speeds from 30 to 100 feet per minute, quick cushioned reversal, ease of adjustment, manual or automatic control, etc.

Users of Oilgear since July 1927 C. B Cottrell & Sons Company chose Oilgear Feeds for their modern, precision Claybourn Roughing and Shaving Machine

Baker Brothers have used Oilgear since 1925. Shown below, the 2-way drilling, reaming, counter-boring and facing machine with Oilgear Fluid Power Feed.



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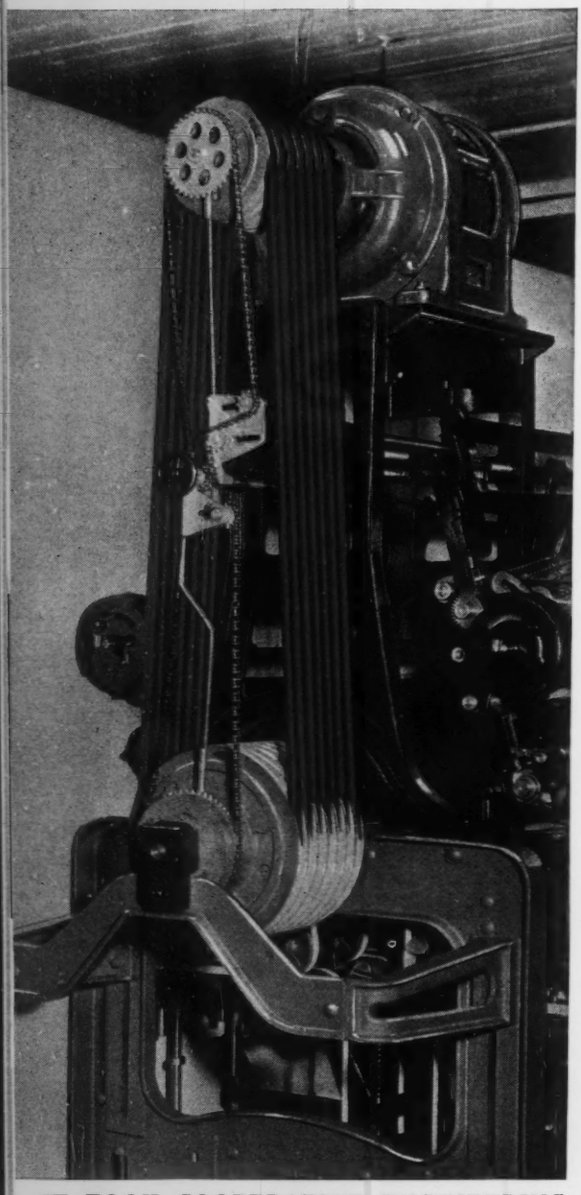
HOW TEXROPE COOPERATIVE ENGINEERING HELPS YOU WIN CUSTOMERS!



IT TOOK COOPERATIVE ENGINEERING to work out the highly effective driving arrangement on the textile mill equipment shown here — with Texrope engineering furnishing Texrope Drives and Vari-Pitch Sheaves for conveniently changed speeds.

Read How Allis-Chalmers Texrope Cooperative Engineering Gives Added Sales Appeal to Your Products ..Attracts New Customers..Increases Your Sales!

Here's a tip for you! If you want to win new customers... and hold old ones under today's tough competitive conditions — use the most modern, most efficient drives you can get for your equipment!

That means using Allis-Chalmers Texrope Drives — proven by thousands of up-to-the-minute equipment installations!

For when you call in Allis-Chalmers Texrope engineering to work cooperatively with your own design engineers, you get the unlimited advantages of huge research and testing laboratories . . . tremendous manufacturing resources . . . and over 90 years of engineering experience in supplying the advancing needs of industry!

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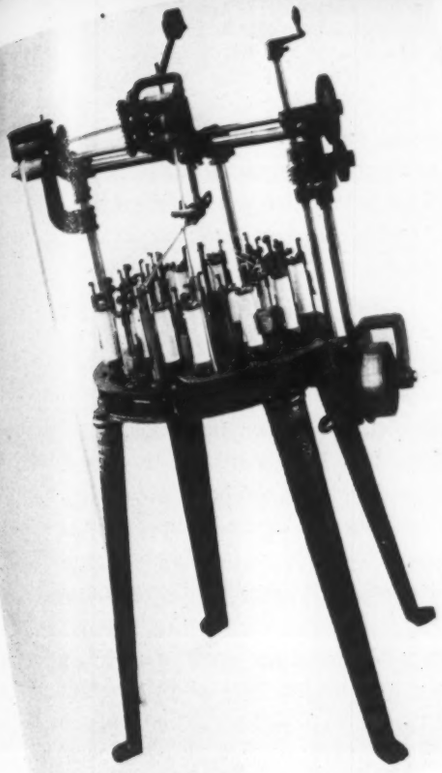
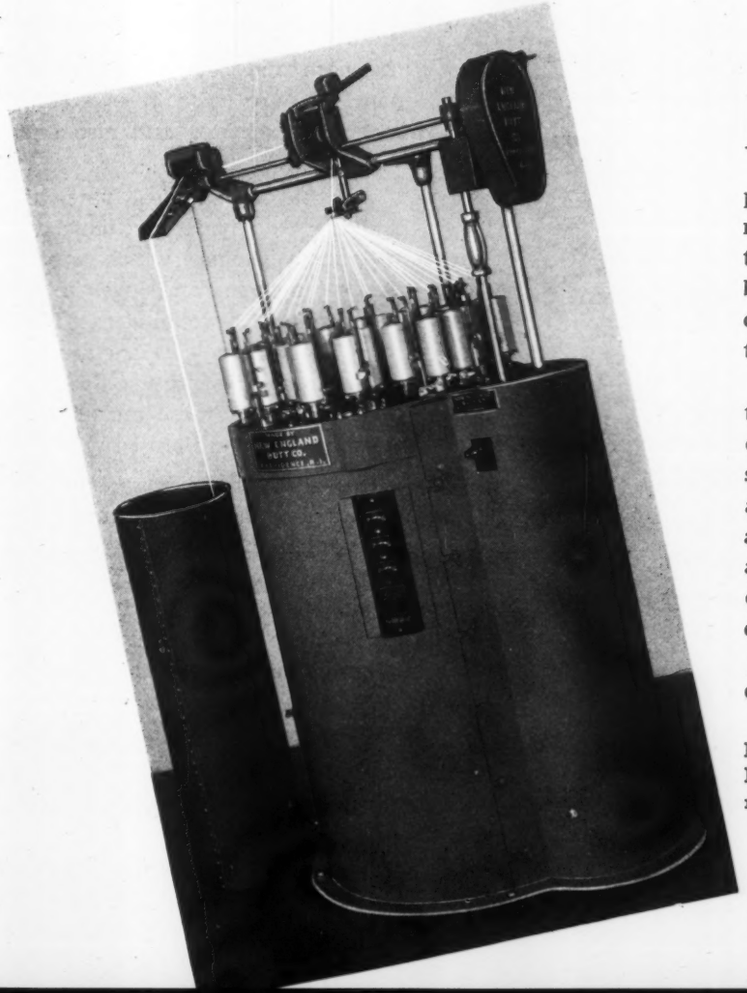


MACHINE DESIGN

Glass Braider Demonstrates Weaving Principles

By R. M. Scott

Chief Engineer, New England Butt Co.



REDESIGN problems associated with adapting a standard production machine for public exhibition purposes presented many interesting phases. The machine, commonly known as a "maypole" type braider, was required to demonstrate braiding of fiber glass yarn into sleeving, called "spaghetti" in the electrical industry.

To produce sleeving equal in quality to that turned out in production and also to demonstrate the operations of braiding, several considerations were involved. Chief among them were (1) operation at slow and production speeds, (2) both automatic and manual change from one speed to the other or to run constantly at either, (3) quietness, and (4) attractive appearance.

Illustrated in *Figs.* 1 and 2 are a standard design and the exhibition braider, respec-

Fig. 1—Top—Standard design of glass braider. Fig. 2—Left—Redesigned machine incorporates many features for exhibition purposes. Photograph, courtesy General Electric Co.

tively. Operating between two plates, a train of gears have horns or flanges which engage the bottom end of the bobbin carriers on which the bobbin of yarn is held. The top plate is formed with a serpentine path to guide the bobbin carriers in and out around the periphery of the plate. This assembly is shown in the phantom view, *Fig.* 3. Above this group an overhead draws up the finished braid and delivers it to a receiver shown at the left of the machine in *Fig.* 2.

Driving the gear train, *Fig.* 4, is a face gear which meshes with a conventional spur gear clutch. All upward thrust on the upright shaft to which the spur gears are secured is eliminated. Thrust on the drive face gear is cut to a minimum and is equal to the separating force encountered in regular spur gearing. This thrust equals the tooth pressure multiplied by the tangent of pressure angle. Also, the location of the spur gear on the upright shaft is not important because the gears will operate satisfactorily with the spur gear meshed in any position axially along the face of the crown gear.

Accurately ground to gage, the top plate and runs in which the carriers travel are carefully designed so that the least amount of wear will result. Directly next to quoit studs are horn gear bushings which serve as spacers in addition to gear bushings. Alternate gears have high and low horns so they can pass as the train of gear revolve. These horns engage the stem of the bobbin carrier and pass it from one gear to the other, thus driving the bobbin carrier about the serpentine path in this ingenious mechanism.

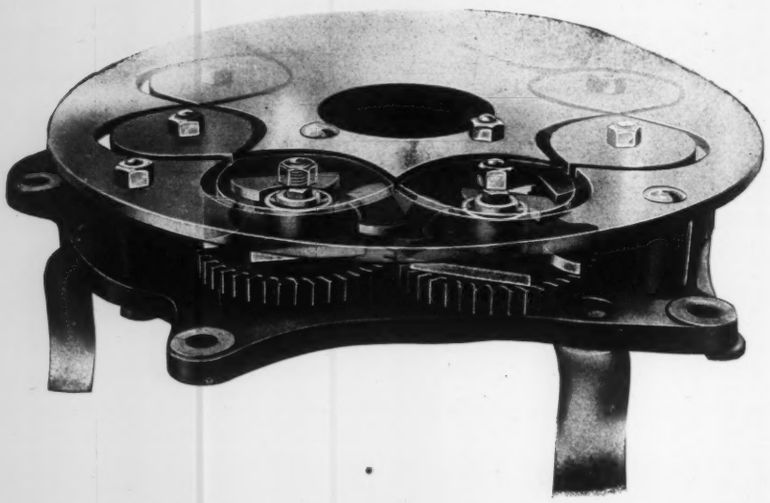
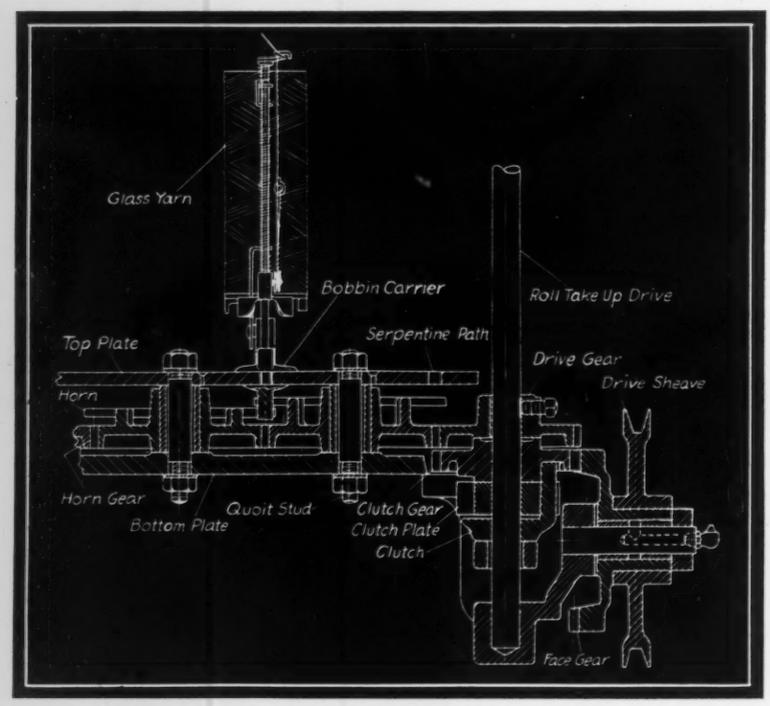


Fig. 3—Above—Phantom view of serpentine path for bobbin carriers.

Fig. 4—Below—Arrangement of base group drive



Because all moving parts such as gears, pulleys, and belts had to be substantially guarded, it was decided to mount the "base group and overhead" on a fabricated steel framework which would serve both as a base and guard, and at the same time conform to the lines of the machine.

This base is 3/16-inch boiler plate rolled into a cylindrical shape with two cross channels to act as a tie across the bottom and also as a bed upon which to mount the motor. One side has a removable cover to give access to the motor, drive belts, and wiring. Motor control box is welded into an opening cut in the frame. Another opening near the base and covered by a removable panel of wire mesh gives access to the rear of the motor and also serves for ventilation.

All cold rolled steel parts, handles, and the "top plate" are chrome plated to give a surface which would not change in appearance over a period of time, and which would attract the passer-by. The bobbin carriers are cadmium plated to contrast with adjacent chrome plated parts. Frame and cast iron fittings are painted light gray.

Operating at either a very slow speed or at regular production speed, or changing automatically from low to high speed, at predetermined intervals, must be accomplished with the least number of moving and wearing parts. Maintenance and mechanical failures must be kept to a minimum on an exhibition braider. While cost on such a machine is not a prime factor, still it must be considered. How then was this speed

variation to be accomplished? A two-speed motor with ratio 6:1 was considered the best and simplest method of drive.

A special ½-horsepower motor with two sets of windings gives a 6:1 speed ratio between the two windings and with a built-in speed reduction gear unit the two required speeds of 40 revolutions per minute and 240 revolutions per minute are obtained on the output shaft. By using a standard gear unit and a standard frame of a 5 horsepower motor, this was done at a reasonable cost. Speed changes requiring changing from one set of windings to the other are accomplished by a magnetic pole changing switch operated from a timing relay. A selector switch in the circuit permits cutting out the timing relay, thus permitting pushbutton operation for

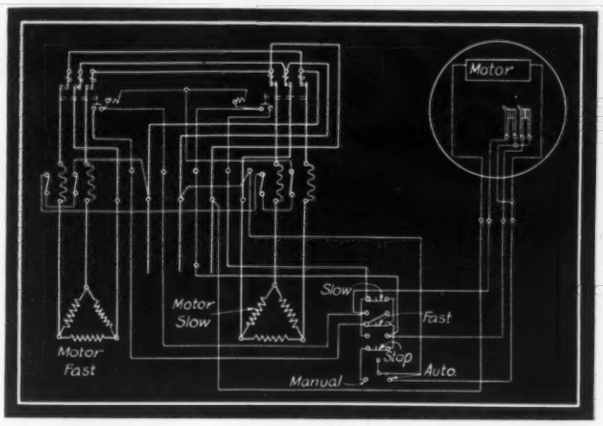


Fig. 5—Wiring diagram for manual and automatic speed change of two speed motor

either high or low speed. A diagram of the circuits employed is shown in *Fig.* 5.

Glass yarn is hard and has a tendency to cut the surface over which it is pulled. It is necessary, therefore, to provide the bobbin carriers with thread guides which will withstand this constant rubbing action. The top and middle thread guides are hardened steel, chrome plated to present a surface harder than that of the glass. At the point where the yarn bends around the tension weight, the regular thread guides were replaced by small steel rolls so that a surface would be present which would move with the glass yarn, thus eliminating chafing of the yarn and wear on the guides.

Maypole type braiding machines are inherently noisy. Most of the noise is caused by the carriers as they travel in and out on the serpentine path about the periphery of the top plate. Therefore, noise could not be eliminated when operating at production speed. Noise is not present, however, when operating at slow speed. The following means were used to eliminate all other noises. The motor was mounted on standard commercial rubber mountings. A V-belt is used for driving between motor and machine.

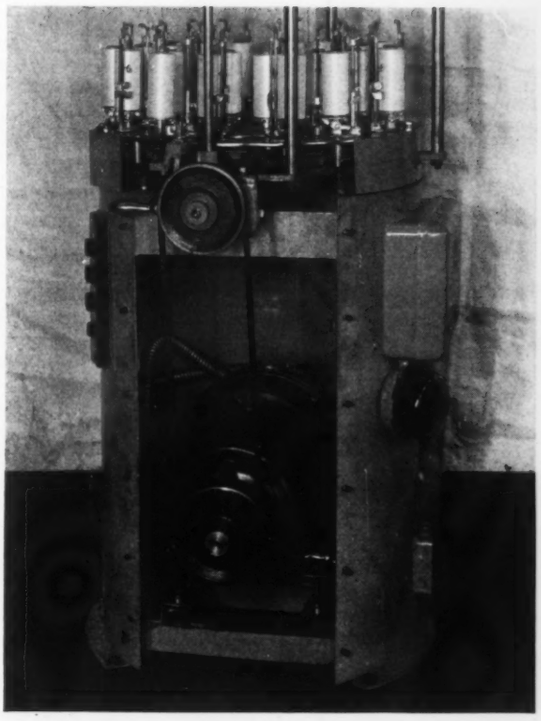
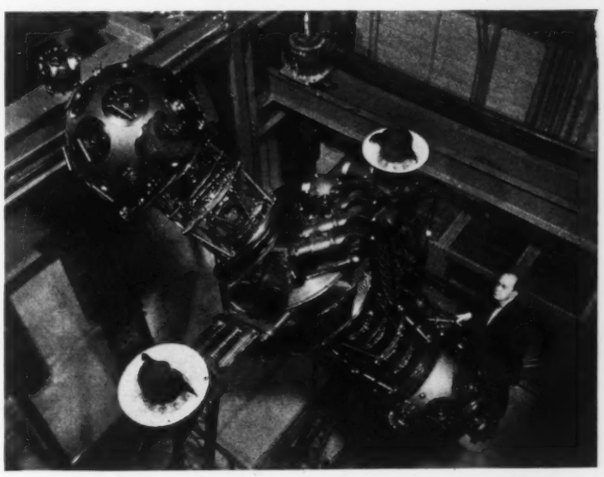


Fig. 6—Special gearmotor and sound absorbing mountings are features of drive

Because steel has the characteristics of transmitting noise and vibration, the moving parts, i.e., the base group, were insulated from the steel base by wooden blocks. Hard wood was used as a rigid mounting was required. The method of mounting the motor, motor controls, and base group are shown in *Fig.* 6.

This machine has proved that these special design features were entirely adequate throughout the past exhibition season at the World's Fair by requiring a minimum of maintenance.



By means of universal joints and four screw gears a Westinghouse motor raises this planetarium to position in Pittsburgh's new Buhl planetarium and institute of popular science. Safety devices prevent collision between the disappearing floor and projector.

Scanning the Field For Ideas

Applying Girder Design to Lathe

TO INCREASE rigidity without adding weight and to utilize material economically are aims of all designers. An example is new type of construction for the Warner & Swasey lathe bed shown in *Fig.* 1 which increases strength and rigidity as much as 30 per cent over previous designs employing conventional box type ribbing.

Diagonal ribbing similar to bridge type girders provides these improvements through better distribution

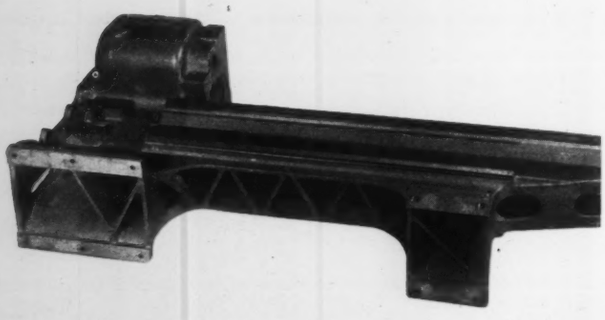


Fig. 1—Diagonal ribbing is employed to increase strength and rigidity of machine bed

of metal. All stiffening sections are on the outside walls of the bed. This not only gives greater freedom from twist and vibration, so important today because of the demand for higher speeds and closer limits without subsequent grinding, but also permits chips to clear more easily through the openings and fall into the pan. The diagonal ribbing extends into the section below the headstock, giving considerably increased strength.

Mercury Engages Clutch

UTILIZING mercury to displace friction segments by centrifugal force, a slip-type clutch has been developed which permits a driving motor to gain speed without load. The load is then gradually picked up at full speed allowing the use of smaller motors when starting under load.

Overloads and other shocks are not transmitted through the clutch to the prime mover. It is protected by the capacity of the clutch limiting the torque transmitted. As shown in the drawing in *Fig.* 2, the clutch consists of four principal parts: Driving member, driven member, clutch segments, mercury.

In operation, mercury displaces the clutch segments inwardly where they engage the drum at the proper time and speed, bringing the driven member to speed smoothly. A large number of clutch segments are used so that as each is buoyed by the mercury contact is obtained for each. This clutch, developed by the Mercury Clutch Corp., Massillon, Ohio, may also be used as an automatic brake to become effective at a given speed.

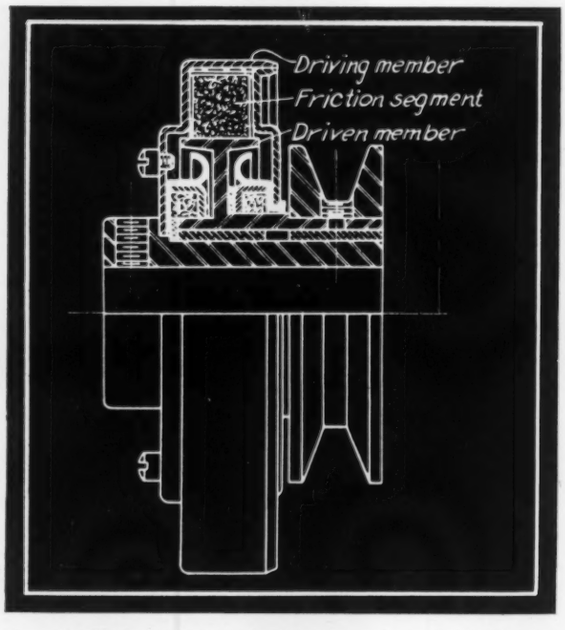


Fig. 2—By centrifugal force mercury displaces friction segments to engage clutch

Balancing Assembled Engine

AFTER balancing component parts of an engine assembly, vibrations beyond the allowable limits may occur from accumulated balance limits of the parts. To overcome this condition Buick has developed a device for balancing assembled engines to within ⅜-ounce-inch.

In *Fig.* 3 is shown an engine in position for balancing. A 15-horsepower electric motor drives the engine through the speed range where vibration occurs. A vibration indicator which is in principle a mechanical oscillograph, depends for operation upon the projection of a beam of light on a screen. Light is reflected from a vibrating mirror to a rotating mirror and then focused on the screen so that an image of the vibration wave is reflected on a translucent screen.

This indicator is mounted at the side of the test fixture so that the pointer of the pickup will rest against the engine. The indicator is driven by a synchronous motor connected to the large motor driving the engine. In this manner the angle of light beam is synchronized in relation to flywheel rotation. Both the amplitude and position in degrees of the

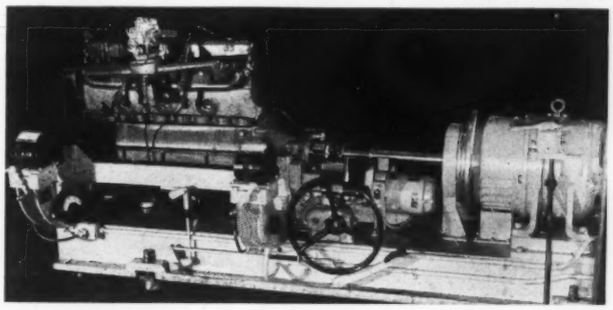


Fig. 3—Projected light beam from vibrating mirror to rotating mirror measures engine unbalance

position of unbalance are shown on the screen. An electric drill is mounted on the machine to drill at the correct location. The amount of drilling is determined by the amplitude of the vibration indicator.

Increases Speed—Reduces Noise

PROBLEMS associated with noise, vibration and unbalanced masses due to cam actions have been practically eliminated in a shoe stitching machine through redesign and use of molded laminated plastics. Cams, cam lever arms, shuttle and accessory parts in the head of this machine, shown in *Fig.* 2, are plastic and have effected reduction in weight, installation cost and horsepower required.

Much of the shock incidental to stitching heavy leather is absorbed by these parts. Resiliency of the plastic material permits an overload of 50 per cent without stress, and with no metal to metal contact the necessity for constant lubrication is reduced. As

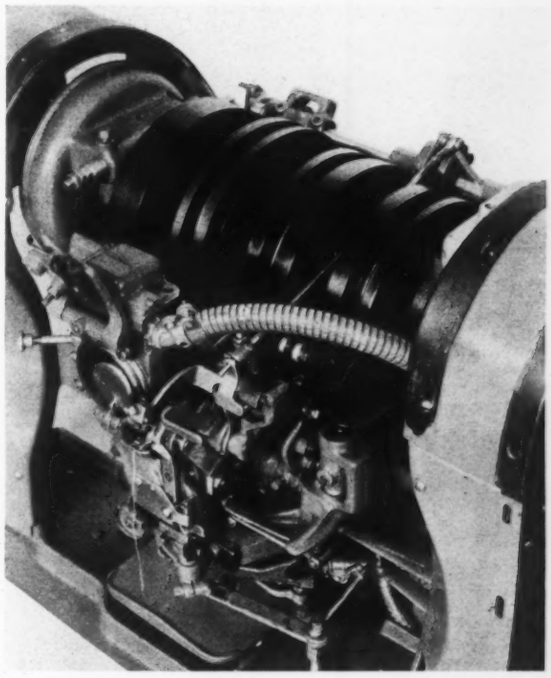


Fig. 4—Plastic cams reduce noise and vibration in machine head, thus permitting increased speed

reported by the *Modern Plastics,* this redesigned machine is capable of increasing operating speeds by 100 per cent.

Refrigerant Cools Motor

UTILIZING parts to serve dual purposes often results in better performance, economies or reduction in size. An interesting illustration is the new Westinghouse hermetically sealed air conditioning compressor. Size of the unit is reduced by using cold refrigerant gas returning from the evaporator to cool the driving motor. Using the gas in this secondary way improves the cooling, simplifies the design and even with extremely high atmospheric temperatures prevents the motor from overheating and tripping off the line at the time when it is most needed.

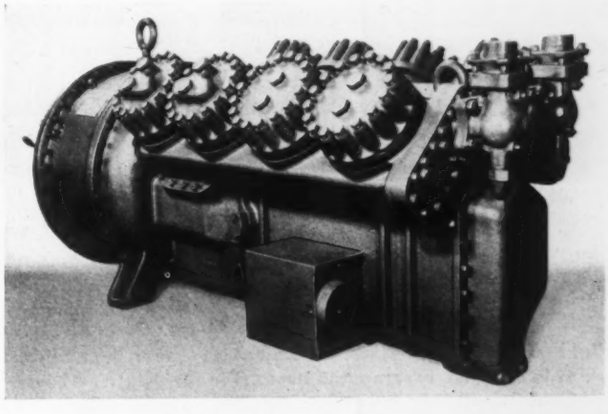
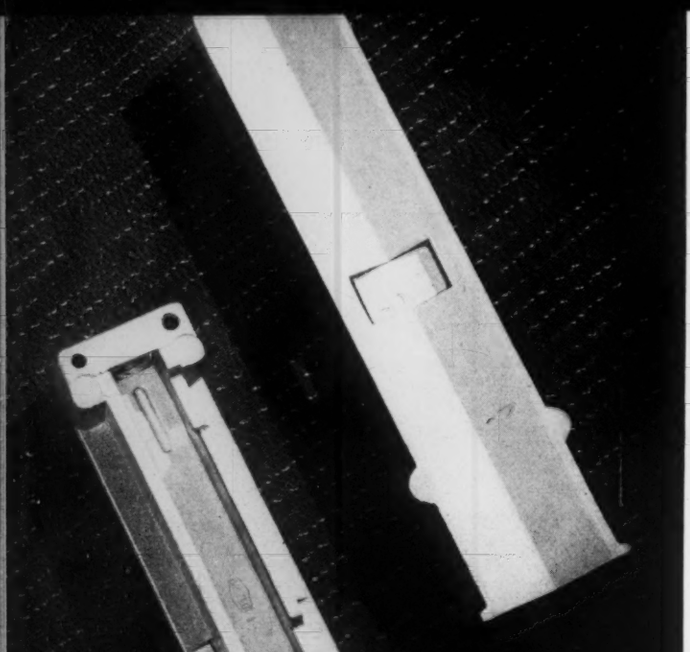
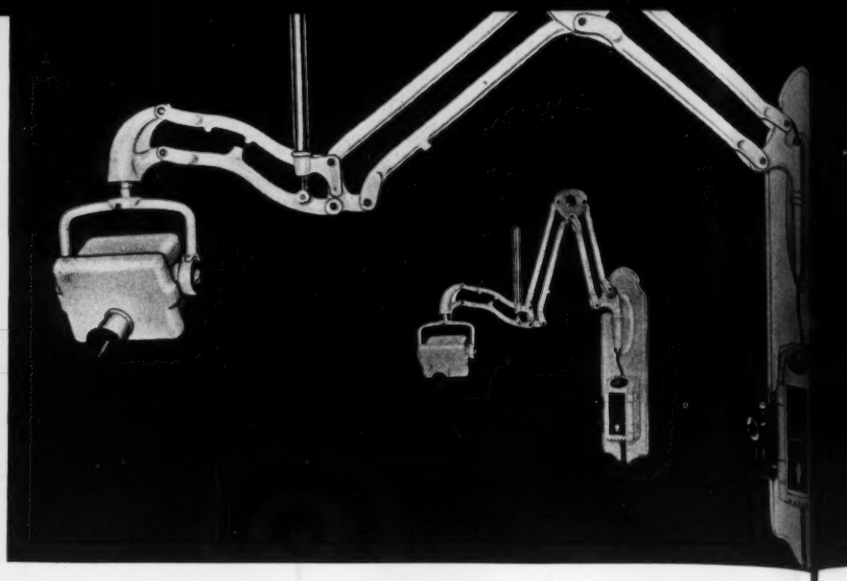


Fig. 5—Hermetically sealed compressor utilizes internal circulation of refrigerant for cooling motor





Magnesium Al
Application M

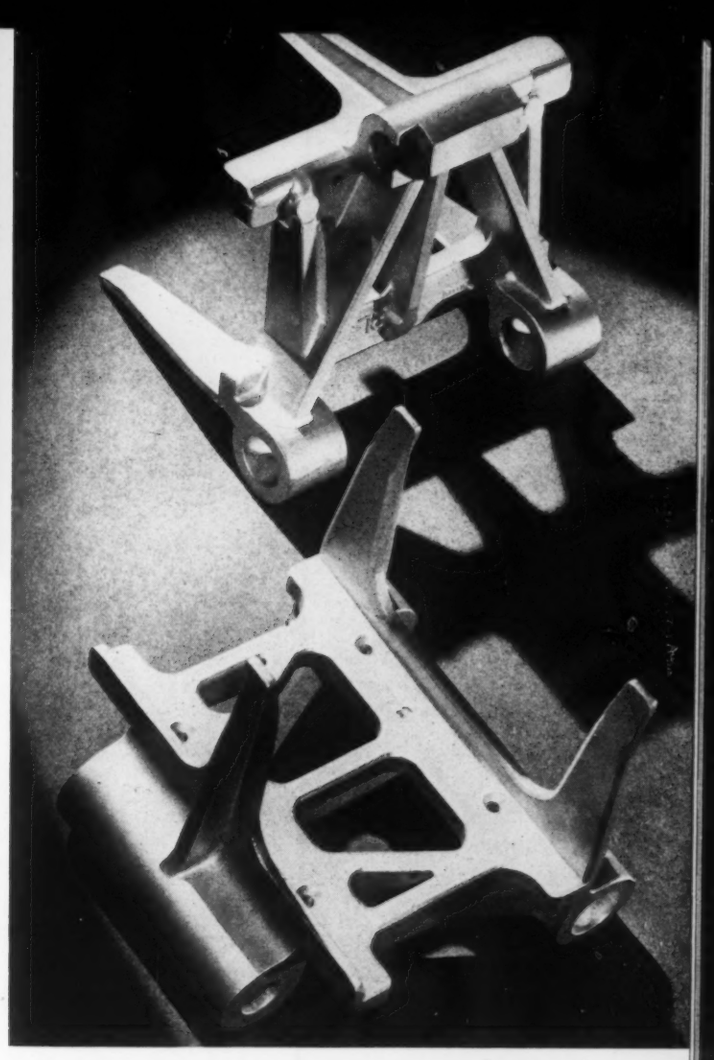
By Geor sw

DESPITE the fact magnesium alloys were first used in quantity in airplanes, and the aircraft market still utilizes about 50 per cent of the total production, applications of these alloys for parts in many other types of machinery—textile, optical, rubber, foundry, shoemaking, cigarette-making, etc. — are steadily expanding.

Undoubtedly the low weight (specific gravity 1.8) of magnesium alloys has attracted new users. Weight saving of magnesium castings over aluminum alloy castings, for instance, is 20 to 35 per cent; contrasted with cast iron, from 50 to 70 per cent; compared with cast steel, 40 to 70 per cent. Machinability of magnesium alloys is better than that of any other common metal, provided cutting tools are kept extremely sharp. This advantage of low machining cost naturally is accompanied by lower tool costs and ease of handling. Tests have shown that workers' efficiency depreciated less during the day when they handled magnesium alloy parts. *Fig.* 2 depicts a portable dental X-ray machine in which weight of structural parts was reduced from one-third to one-half the weight formerly necessary. To permit compact design, the problem was faced of getting full extension with minimum vibration.

To show at a glance the various characteristics of magnesium alloys, TABLE I has been prepared, listing composition, uses and mechanical properties of some of the most common alloys. In all cases, magnesium constitutes the remainder of the metal in addition to the alloying elements shown. Typical and *as-cast* values are given for sand castings in the cases of tensile strength, yield point and elongation. Heat treating or heat treating and aging will raise the figures appreciably. For instance, a sand cast magnesium alloy containing 10 per cent aluminum and .1 per

Fig. 1—Left, Above—High coefficient of linear expansion made magnesium alloy suitable for this die cast thermostat base. Fig. 2—Right, Above—Weight of structural parts was reduced one-third to one-half in this portable dental X-ray machine. Fig. 3—Right—Magnesium alloy extrusions and castings for textile machinery parts



Als Find Wider

n Machine Parts

Georgiswold

cent manganese has a typical tensile strength of 22,000 pounds per square inch. Heat treated, its tensile strength is 33,000 pounds; heat treated and aged, 34,000 pounds. This ratio is merely indicative, not constant.

In the table, values for plate and sheet are those for annealed metal and apply to thicknesses of .016 to .250-inch. Thicker material may vary somewhat. "As extruded" figures are given for extruded shapes.

Magnesium alloys may be treated in many ways, resulting in various forms. To avoid confusion, details of these operations will be discussed separately.

CASTINGS: Choice of a casting alloy depends principally on the stresses expected in operation (static, fatigue or impact), on the existence of corrosive conditions and on foundry considerations. Heat treated aluminum-bearing magnesium alloys are frequently used for highly stressed applications. Where impact stresses are involved alloys containing zinc in addition to aluminum have been found excellent. Manganese-containing alloys may be readily welded; silicon-bearing alloys are preferred for castings that have to be pressure-tight.

Design of magnesium alloy castings merits careful attention. Edge stresses and notch effects should be avoided, therefore in all parts transitions of cross section must be carefully blended. In general, the radius of a connecting fillet should be about the same as the thickness of the thicker of the two adjoining sections. In many instances the thin wall is tapered into the thicker wall and a connecting fillet used also. *Fig.* 6, a vacuum sweeper fan, illustrates such a design.

Fig. 4, a sand cast spray gun, incorporates magnesium alloy because of lightness, economy in casting and machinability, and advantages of assembly. Low density of the metal permits a large grip and perfect balance without coring

Because the modulus of elasticity of magnesium is lower than that of other

Fig. 4—Left, Above—Low density of magnesium alloy permits large gun grip and perfect balance without coring in this sand cast spray gun. Fig. 5—Right, Above—Light weight and consequent rapid movement led to use of magnesium for die cast roller chain link

TABLE I

Typical Magnesium Alloys—Composition, Uses, Mechanical Properties

Alloys Per Cent	Uses	Tens. S'th. lb./sq. in.	Yield Point lb./sq. in.	Pct. Elong. in 2 in.	Brinell hardness	Impact ft. lb.	Fatigue endurance limit—lb./sq. in.
Al 6, Mn .2	Plate, sheet	39,000	20,000	15	57		
Al 6, Mn .2, Zn 3	Sand castings	27,000	12,000	5	55	3	10,000
	Forgings						
Al 6.5, Mn .2, Zn .7	Press forgings	40,000	24,000	10	57		17,000
	Extruded shapes	43,000	30,000	17	54		17,000
Al 2.5, Mn .3	Hammer forgings	37,000	26,000	11	51		10,500
Mn 1.5	Plate, sheet	32,000	16,000	15	48		
	Extruded sections	42,000	27,000	6	42		6,000
	Sand castings	14,000	4,500	3	33	9	
	Forgings			3	60	2	
Al 9, Mn .2, Zn .6	Die castings	33,000	21,000	16	59		17,000
Al 3, Mn .2, Zn 3	Press forgings	41,000	24,000	19	51		18,000
	Extruded shapes	42,000	30,000				
Al 6.5, Mn .2, Si .2	Die castings	27,000	17,000	4	50	3	

metals, larger areas must be used to carry stresses in places of concentrated load. The desired stiffness may be attained, without increasing weight, through more ribs or box-like cross sections.

A slight fire hazard exists when magnesium alloys are machined, particularly if the cuts are fine, but simple precautions will eliminate danger. Tool friction is most apt to be the cause of fire, hence the necessity for sharp tools with adequate clearance to minimize friction. Immediately after machining, magnesium alloy castings should be given a chemical

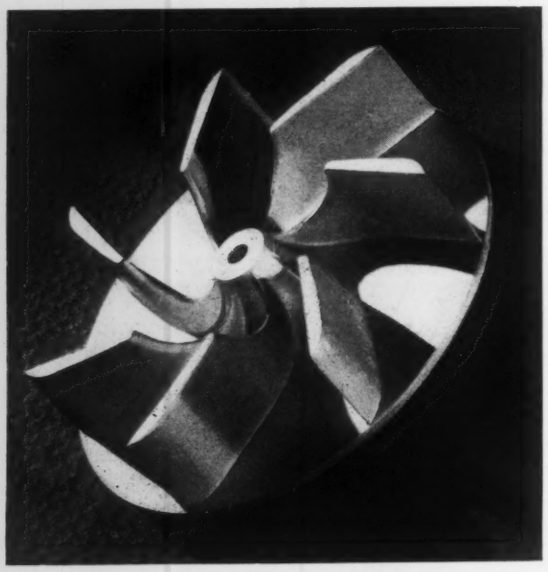


Fig. 6—Vacuum cleaner fan. Transitions of cross section must be carefully blended in castings

surface treatment to improve their corrosion resistance and to offer a good base for subsequent painting. A cleaning operation to remove grease and oil should precede this treatment. Numerous surface treatments have been developed.

DIE CASTINGS: As with sand castings, die castings of magnesium alloys should have comparatively large fillets and sharp corners should be rounded. Fortunately, the newer high-pressure methods of die casting have been found particularly adaptable to magnesium alloys. Savings in cost can be realized through spreading die expense over a large quantity of castings and through reduced machining.

Fig. 1, a thermostat base, is an interesting example of a magnesium alloy die casting in which this material was found especially valuable because of its high coefficient of linear expansion. Another die casting is *Fig.* 5, a link in an endless roller chain, for which magnesium alloy was chosen because of its light weight and consequent ability to be moved rapidly.

FORGINGS: Magnesium alloy forgings and pressings are inherently suitable for high-stress applications, and their high tensile strength and yield point in comparison with other forms may be seen in TABLE I. Press forgings have higher strength but cost more and cannot be made as close to dimensions as hammer forgings.

EXTRUDED SHAPES: The textile industry is one of the latest users of numerous extruded parts of magnesium alloys. Many of the parts in *Fig.* 3 are extruded, the others castings. Through substitution of magnesium alloy for ferrous metals, weight in some textile machinery parts has been reduced 60 to 75 per cent, permitting higher speeds and consequent increase in production. An especial advantage of magnesium extrusions is their easy manufacture into special shapes which could not be made by rolling.

SHEET AND PLATE: Extensive uses have been developed for magnesium alloy sheet, particularly because of its good welding characteristics, although special welding fluxes are required. Since the flux is very corrosive, the weld must be thoroughly cleaned afterward. Hence welds should be designed so the flux is not trapped, and lap welds should be avoided.

Future years undoubtedly will see constantly greater use of magnesium alloys for many types of machinery, as designers become more familiar with facilities and techniques. Full potentialities have been far from realized. When it is remembered that use of magnesium alloys in the United States did not actually begin until 1915, the amazing development so far is only indicative of what may come.

The editors appreciate the co-operation of the following companies in the assembly of information and illustrations for this article: American Magnesium Corp. (*Figs.* 1, 3, 5 and 6); Dow Chemical Co. (*Figs.* 2 and 4); Perfex Corp. (*Fig.* 1).

New Laws Speed Patent Procedure

By George V. Woodling

RECENT amendments to the patent statutes deal primarily with the problem of making the seventeen-year life of a patent begin as soon as possible after the invention is created. Under previous practice, issuance of patents was often delayed for many years, thus producing an effectual extension of the seventeen year monopoly. These new statutory changes decrease this opportunity for extension by requiring inventors to file early applications as well as expediting prosecution of the patent.

In accordance with the former statutes, an inventor could, without constituting a legal bar to obtaining a valid patent, manufacture and sell his invention for a period of not more than two years before filing a patent application. This, of course, assumes that no other factors existed to interfere with the grant of a valid patent. After the application was filed, the prosecution might then continue for several years. The longest patent prosecution on record was for a period of 36 years. The invention was meritorious and related to a method of recording and reproducing sound by a photographic process. Application was filed on October 22, 1880 and the patent was granted on October 31, 1916. Similar cases have been in the patent office for more than 15 years and several hundred others for more than ten years. The foregoing, of course, represent extraordinary situations. On the other hand some cases require less than a year.

At first glance, it may seem ill-advised to delay the issuance of a patent particularly in view of the fact that there is no protection until a patent is granted. Even if a competitor begins to manufacture and sell the inventor's device there is no recourse, as long as the inventor's patent application is still pending. Competitors may even flood the market without being enjoined or sued for damages. Neither are the rights created by the issuance of a patent retroactive, so as to apprehend the competitor

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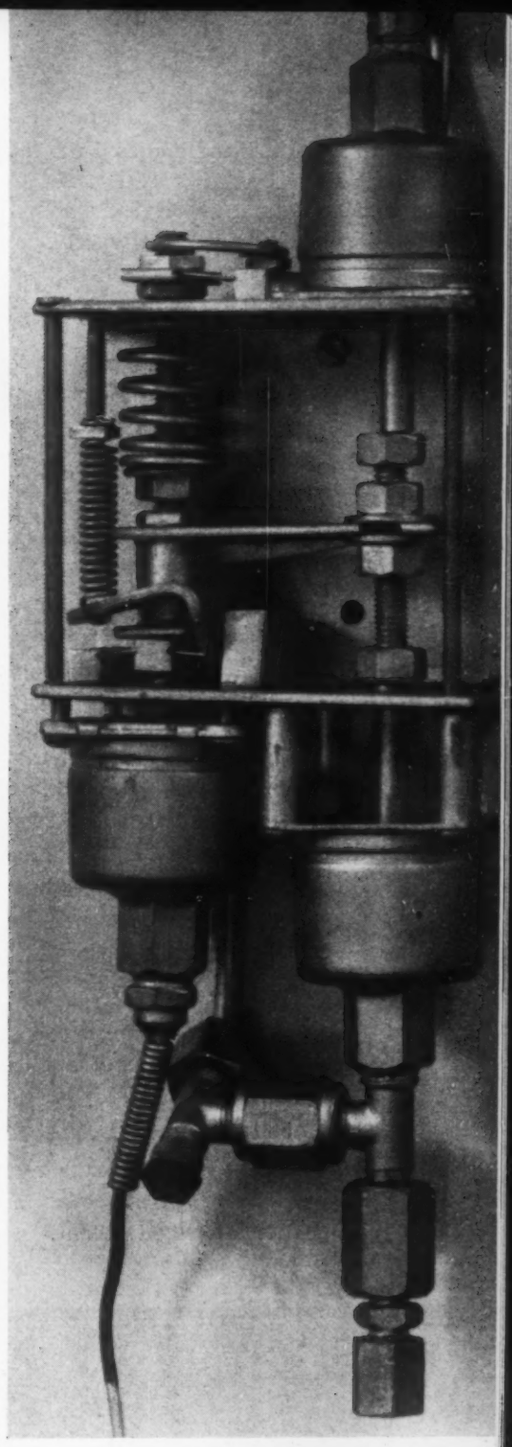


Fig. 1—Valve upon which inventor was granted priority over previously granted patent similar device

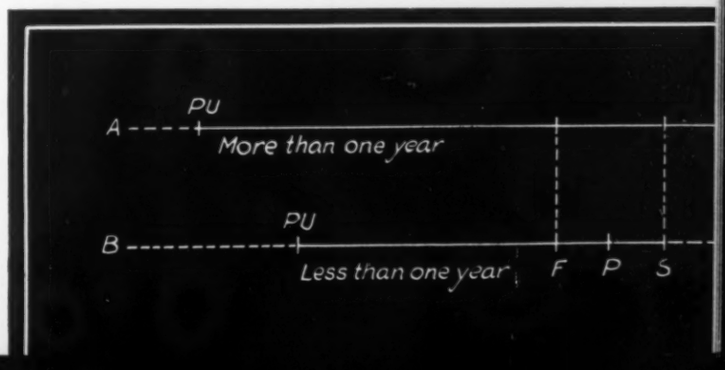


Fig. 2—Diagram illustrates patent validity restrictions through public use of more than one year

who manufactured and sold the invention during this period. There actually are many advantages to be gained however in protracting the prosecution which may greatly outweigh the disadvantages of not being able to sue infringers during the pendency of the application. The most obvious reason for delay is to cause the seventeen-year term of the patent to coincide with the manufacturing period which will produce maximum financial returns. This observation is particularly true when the invention is born before its time.

Another reason for delay is to give the inventor sufficient time for experiment and consultation before his patent issues. As a result of experimental development it may be found that additional claims may be injected into the application to strengthen the patent. Besides affording an opportunity for experiment, delay allows the inventor to analyze the designs of competing devices introduced on the market after the filing date of his application and to make his patent cover features which are common to those shown in his application. Without this analyzation, the patent might well have issued without sufficient protection.

The new statutory acts may be listed under the following summary of each act:

1. Reduces public use period from two years to one year.
2. Authorizes Commissioner of Patents to require response of applicant within less than six months.
3. Abolishes renewal applications.
4. Reduces period from two years to one year within which applicant may copy claims from an issued patent.
5. Abolishes appeals to Board of Appeals of Patent Office in interference cases.

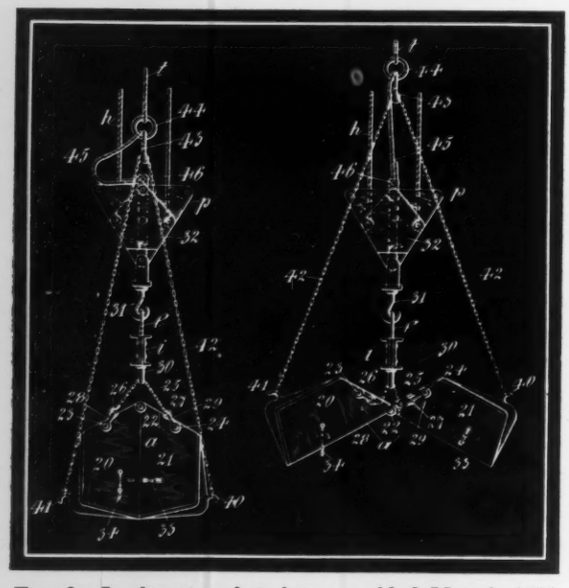


Fig. 3—Application for skip was filed May 3, 1906, renewed March 14, 1907 and again June 16, 1908

Act 1 takes effect August 5, 1940 and all applications for patents filed prior to that date and all patents granted on such applications are governed by the two year public use rule. The effect of this new change in the law may be stated: If an invention was in public use or on sale in this country for more than one year prior to the filing date of the patent application then the inventor is barred from obtaining a valid patent on his invention.

It is important to realize that the public use period functions when invoked as a bar to the grant of a valid patent and does not create for the inventor a positive absolute right during which time he can file a patent application and obtain a valid patent. There are many other bars and conditions that might stand in his way in obtaining a valid patent. Thus the idea entertained by a few manufacturers that they have a positive legal right to manufacture and sell their products for two years (present statute) before filing a patent application, is erroneous. A public use by a competitor who has manufactured or sold substantially the same invention for a period in excess of the statutory use period operates to invalidate a patent with the same force and effect as if the public use were made by the patentee himself. This is illustrated by the diagram, *Fig.* 2, where *A* represents a competitor and *B* the patentee. The length of the lines is indicative of the passage of time.

Use Restricts Inventors

In the diagram, the public use by *A* is indicated by the symbol *PU*, which is the date that he started to manufacture and sell his device publicly. He does not apply for a patent. Unknowingly to *A*'s activity, *B* invents substantially the same device and starts to manufacture and sell it at *PU*. Thinking that he has one year (new statute) in which he can manufacture and sell his device, he files his application at *F* and obtains his patent at *P*. Subsequently, he learns that *A* is manufacturing and selling a device covered by his patent and sues *A* at *S* for patent infringement. In the trial of the case, a court would declare *B*'s patent invalid because the public use by *A* was more than one year prior to *B*'s filing date. The patent office would not have granted the patent to *B* if it had had knowledge of the prior public use by *A*.

When the patent office grants a patent, the patent is prima facie valid; that is, valid upon its face. But should *B* later sue *A*, an unauthorized manufacturer of *B*'s patented device, as illustrated, then the manufacturer may call in witnesses who have seen *A*'s device in public use and attempt to prove to the satisfaction of the court that *B*'s patent is invalid because of the public use in the United States by *A*. If the defendant, *A*, can establish such proof to the satisfaction of the court, the court will declare *B*'s patent

invalid, in which case the defendant, *A*, is not liable for the unauthorized manufacture of *B*'s patented device.

A single instance of public and successful use of the invention, such as illustrated by *A*'s use in the diagram, is sufficient to invalidate a patent. The embodiment of an invention, to amount to public use by *A* for example, must be in such form as to render it capable of practical and successful use. A mere making of a model will not constitute a public use.

Requires Early Response

Act 2 became effective in the Patent Office November 15, 1939. As part of the actual examination of a patent application, the examiner searches among prior patents and looks for "anticipation," that is, looks for a prior patent which shows and describes a device upon which the claims of the application read. If he finds such a patent he rejects the claim as being "anticipated" or met by the prior art. When the examiner finishes his examination, he writes a letter to the applicant's attorneys and sets forth the prior patents which he considers pertinent; his rejections together with the reason for his rejection; and the allowances, if any. This letter usually is referred to as an "office action." The examiner's letter bears a date, and the inventor formerly had six months in which to respond to the points raised in the examiner's letter. This has now been changed by stating that the applicant has "six months or such shorter time, not less than thirty days, or any extensions thereof, as shall be fixed by the Commissioner of Patents in writing to the applicant." If the attorney fails to respond within the required time, the application will be regarded as abandoned, unless it shall be shown to the satisfaction of the Commissioner that such delay was unavoidable.

Renewal Applications Eliminated

Act 3 abolishing renewal applications became effective August 9, 1939. Under the former practice, an applicant could spend several years in prosecuting his application to a state of allowance and then by failing to pay the final fee renew the application and resume prosecution for several years more. It has been held that an application may be renewed, reallowed, reforfeited and a second renewal secured, provided that the second renewal was filed within the statutory period. This is what occurred in the prosecution of the patent covering the device shown in Fig. 3. The renewal of applications was orginally enacted to afford relief to an applicant who was unable to pay the final fee when it became due at the end of the six months period after allowance. But there soon developed a practice wherein corporations owning large numbers of inventions would resort to this procedure to delay the prosecution. To protect

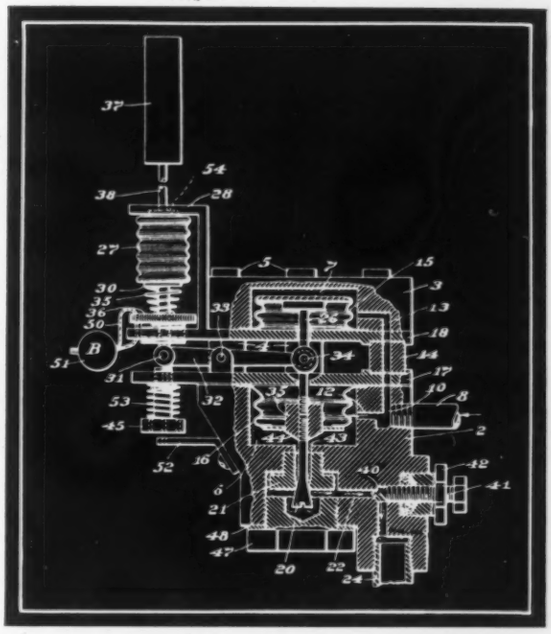


Fig. 4—Valve patent declared invalid by interference although granted previously

impecunious inventors, the new law states "that the Commissioner of Patents may in his discretion receive the final fee if paid within one year after the six month's period for payment has passed—." This merely gives the inventor who is unable to pay his final fee a period of grace.

Claims May Be Copied Within Year

Act 4 reducing the period from two years to one year within which an applicant may copy claims from an issued patent takes effect August 5, 1940. This procedure may be explained by reference to *Figs.* 1 and 4. The patent upon the refrigeration valve in *Fig.* 4 was issued on November 26, 1935 with 4 claims. On October 26, 1936, the Patent Office rejected the claims of the application upon the refrigeration valve in *Fig.* 1 due to this prior patent; the Patent Office contended that the two valves were substantially the same.

Following the Patent Office rejection, and on April 23, 1937, the inventor of the valve in *Fig.* 1 copied two claims of this patent and requested the Commissioner of Patents to declare an interference to determine priority of the two copied claims which covered common subject matter to both valves. The other two claims of the patent were not copied as they related to features which were not common to both valves. An interference was accordingly set up by the Patent Office and the two claims in issue were awarded to the inventor of the valve in *Fig.* 1 as he proved an earlier conception date and an earlier actual reduction to practice of the invention.

From the above set of facts, it is noted that the

(*Concluded on Page* 80)

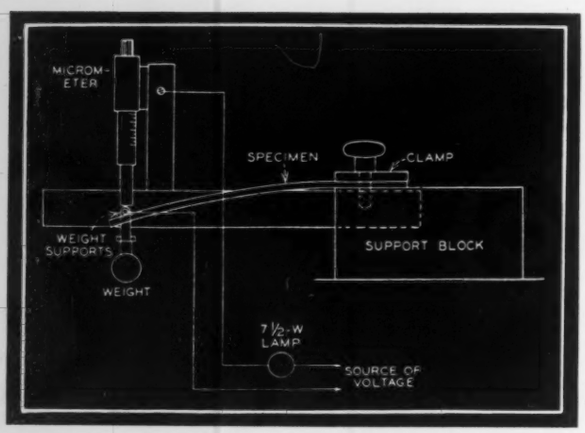


Fig. 1—Schematic diagram of test apparatus, showing how samples of plastics were supported as simple cantilever beams and loaded by dead weights at the end

How Use Affects Physical Properties of Plastics

By J. Delmonte

AS ENGINEERING materials, one of the singular characteristics of organic plastics is their response to thermal influences. In fact, they are generally classified as thermosetting or thermoplastic, distinguishing between materials which are profoundly influenced by heat and those only slightly affected.

Another characteristic of plastics which has a decided influence on the design and application of the materials, is their behavior under applied stresses.

The media in which the plastic materials are operating may also have a bearing upon their properties. Particularly noteworthy are such influences as the

From a paper contributed by the Rubber and Plastics subdivision, annual meeting, ASME.

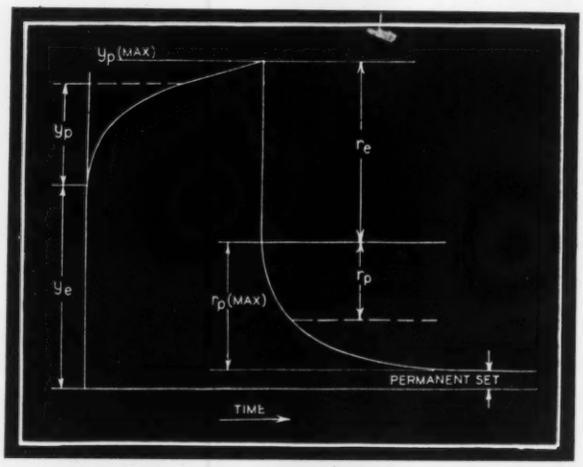
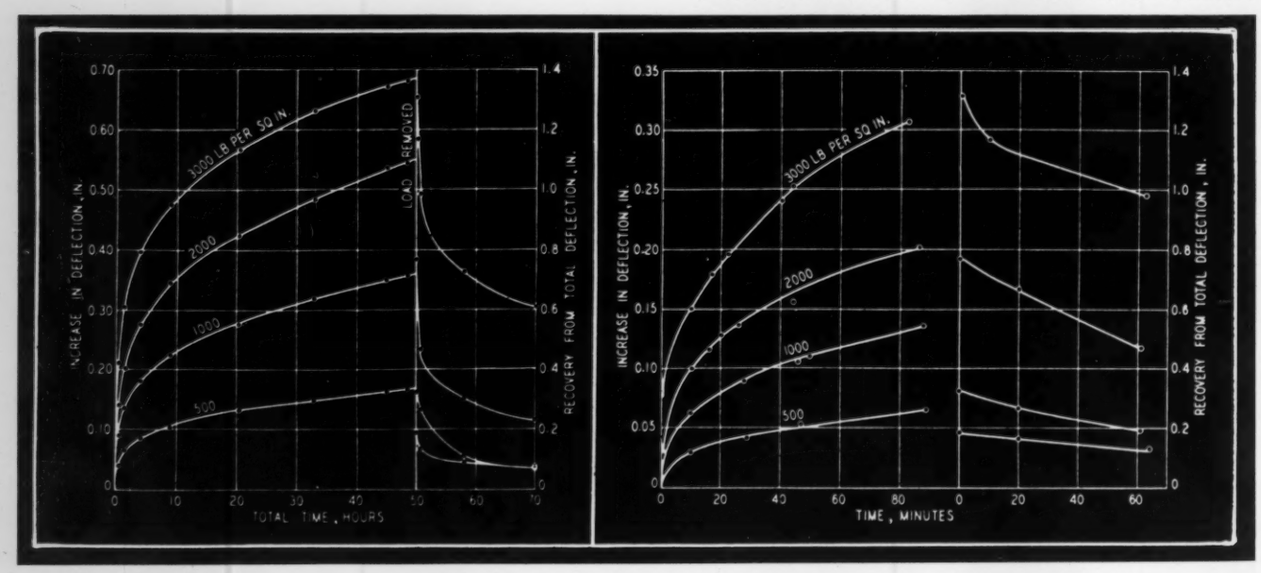


Fig. 2—Typical time-deformation characteristic. Fig. 3—Left, Below—Time-deformation curve for cellulose acetate at 50 hours. Recovery from maximum fiber stress in this case is great. Fig. 4—Below—Time-deformation curve for cellulose acetate, 90 minutes.



actinic rays of sunlight, high humidity, and the corrosive effects of chemicals, any of which may cause a loss in utility of the material. Consequently, in examining the permanence of the physical properties of plastics, the following tests may be pursued:

1. Creep and cold flow at various stresses and at various temperatures, for different lengths of time and recovery upon removal of stress
2. Organic plastics at elevated temperatures
   a. Properties of the plastics at these temperatures
   b. Properties of the plastics after return to room temperature, after exposures for different periods of time
3. Effect of immersion in water or high humidity upon the properties of organic plastics (or in lieu of water, the use of corrosive chemicals).

Under constant load the following may be presupposed to take place:

1. Upon placing the material under stress, there follows immediately a very rapid elastic deformation.
2. This is followed by a plastic deformation which depends upon the stress, temperature, and the time of application.
3. Under the continued application of load, the velocity of this plastic deformation will change with time. The internal structural elements contributing to this deformation characteristic possess internal friction (as sliding friction between adjacent long chain molecules), and an inertia effect, depending upon the rate of change of deformation velocity.
4. Upon removal of the load, there is a rapid, immediate elastic recovery, followed by a relaxation period in which further recovery from deformation occurs, depending upon the manner in which the material was stressed.
5. Another condition admits the possibility that the elastic structure can be deformed past its elastic limit, besides the plastic deformation exhibited by those elements not part of the main elastic structure.

Method of Making Tests

In this investigation samples of the plastic materials were supported as simple cantilever beams and loaded by dead weights at the end as shown schematically in *Fig.* 1. The apparatus tested four samples simultaneously, making it possible to observe materials under four different maximum fiber stresses during the same period of time. The equipment was enclosed within an insulated chamber, thermostatically controlled with air circulation, to 85 degrees Fahr., plus or minus 2 degrees Fahr. Four micrometers attached solidly to the support block, measured the end deflection of the specimens by electrical contact with the support for the weights.

THEORY: Within certain stresses, the initial rapid deflection of the simple cantilever beam test specimens is a truly elastic deformation, the magnitude of the deflection and the maximum fiber stresses being calculable from the following well known formulas, which assume validity of Hooke's law and uniform

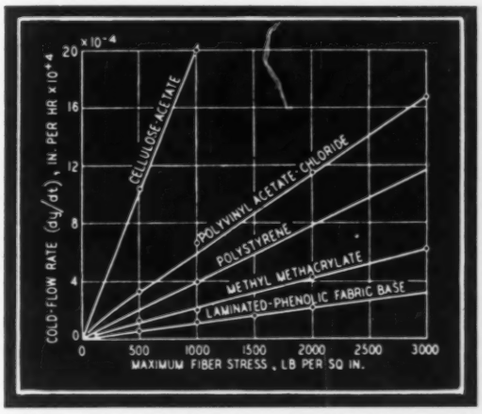


Fig. 5—Cold-flow rate as function of maximum fiber stress. It may be deduced from this that cold flow occurs even at very low stresses

distribution of stress-strain in compression and tension, about the neutral axis:

$$y_e \text{ (max.)} = W L^3/3 E I \text{ and } M = S I/c$$

where y_e is the true elastic deflection; W, weight supported at end of beam; L, distance from point of support to the weight; E, modulus of elasticity; I, moment of inertia; S, maximum fiber stress; M, maximum bending moment and equal to $W \times L$; and c, distance

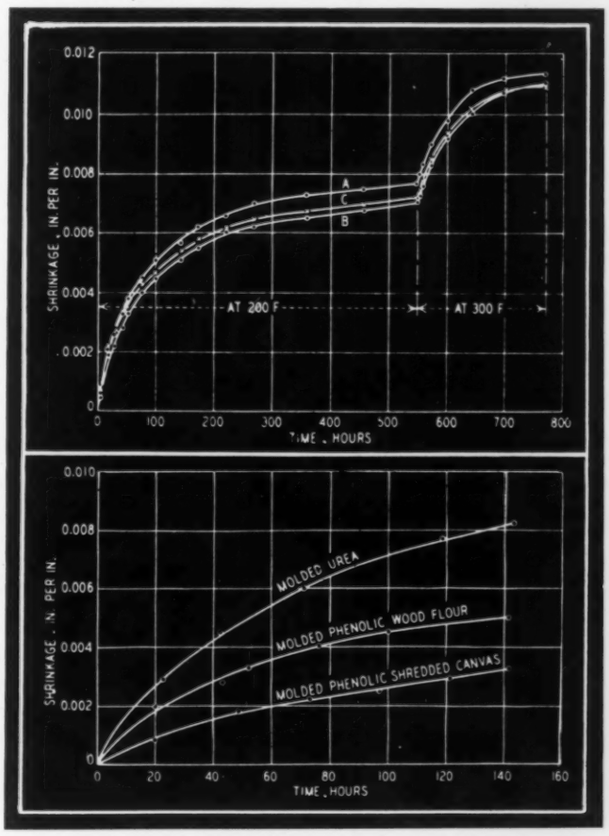


Fig. 6—Top—Aftershrinkage caused by temperature occurs in addition to normal thermal shrinkage. Here are results for molded phenolics on high temperature exposure for cures of A, one minute, B, two minutes, C, ten minutes. Fig. 7—Above—Shrinkage of several molded plastics at 200 degrees Fahr. Aftershrinkage must always be taken into consideration

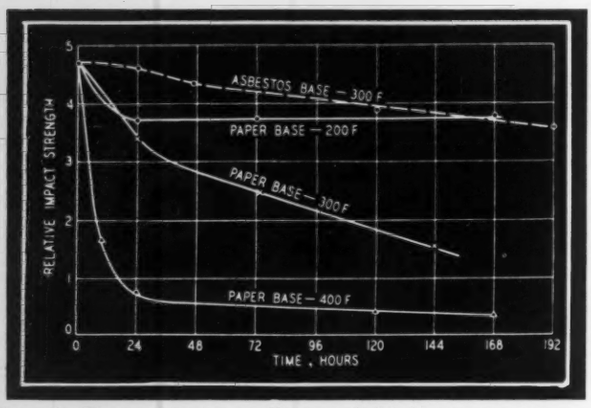


Fig. 8—Data showing effects of high temperature exposure on impact strength of laminated phenolics

from neutral axis to outermost fiber.

Immediately following the truly elastic deformation, the phenomena of creep and cold flow will commence, increasing the amount of deflection. There are two stages of plastic deformation:

1. Rate of change of deformation with time changes from a maximum to a minimum, constant rate
2. Rate of change of deformation with time remains constant for an indefinite time for a given fiber stress (or given integrated stress values).

Unlike crystalline materials which may work harden, none of the plastics included in this test behaved that way. For the sake of definition, cold flow may be described as that constant rate of change of deformation with time, which a material will exhibit after being subjected to a certain stress for a certain length of time, at a constant temperature. Creep may be described as that stage of plastic deformation where velocity of the deformation rate changes with time.

In view of the creep and cold flow characteristic of the plastics, the question naturally arises as to what interpretation should be given to the modulus of elasticity. Strictly speaking, it would be made a function of stress, strain, temperature, and time, inasmuch as the exact location of the elastic limit is open to some question. In the bending of beams beyond the proportional limit, Timoshenko has proposed that in the well known formula $M = EI/p$, that E be replaced by E_r, a variable modulus of elasticity to be determined from the stress-strain relationships.

RELAXATION: The next point to consider is the relaxation upon removal of stress. If the molecular structure were such that elastic phenomena and plastic phenomena operated independent of one another, a rapid elastic recovery would ensue with no further recovery. Such a condition does not exist, however, and the energy for the plastic recovery (sometimes referred to as the "elastic after-effect") is derived from a portion of the elastic structure. The rate of recovery will still depend upon a coefficient of viscous impedance and a coefficient of internal friction, both cooperating to make the rate an exponential function of time. Further, when a constant deformation is maintained under loading conditions, we may expect an exponential recovery of stress.

If we admit the existence of a true elastic portion of the molecule, how then are we to determine correctly its true elastic limit, if the results for whole structure are susceptible to plastic influences even at low stresses? Grouping the deformation and recovery phenomena, there is the following:

Elastic Deformation + Plastic Deformation = Elastic Recovery + Plastic Recovery + Permanent Set.

If upon the removal of the load maximum plastic recovery exceeds maximum plastic deformation, we have then exceeded the true elastic limit of the material, for it is only through a nonelastic deformation of the true elastic structure, resulting in a retardation of the elastic recovery, that this condition would be true, *Fig.* 2. Thus the true elastic limit of amorphous material may be defined as follows: When a stress is applied such that the elastic deformation exceeds the elastic recovery, the applied stress exceeds the elastic limit of the material. This definition is true regardless of how long the stress is applied.

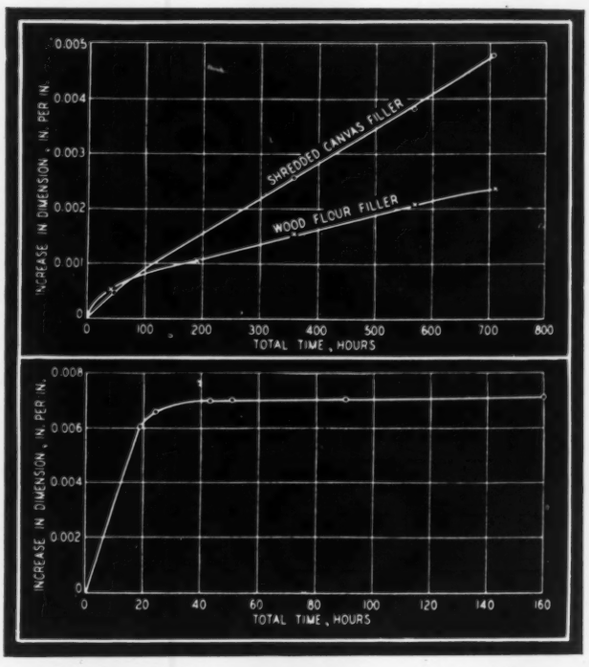


Fig. 9—Top—Moisture has an important influence on the permanency of physical properties of plastics. Here is the dimensional stability at high humidity for hot molded phenolics. Fig. 10—Above—Comparison with Fig. 9, showing dimensional stability at high humidity for molded cellulose acetate

Five materials were tested and a comparison made of their relative deformation as a function of time. As examples, *Figs.* 3 and 4 show time-deformation curves for cellulose acetate at 50 hours and 90 minutes, respectively.

TABLE I

Cold Flow and Creep Characteristics of Various Plastics

Material	Total initial elastic deformation inches	Total plastic deformation at 1 hour inches	Pct. of initial	at 100 hours inches	Pct. of initial	Coefficient of resistance to cold flow
Polyvinyl Chloride-Acetate	.407	.020	4.9	.106	26.0	1.66×10^8
Polystyrene	.370	.012	3.2	.090	24.0	2.5×10^8
Cellulose Acetate	.727	.117	16.1	.480	66.0	0.5×10^8
Laminated Phenolic (fabric base)	.166	.012	7.2	.036	22.0	9.08×10^8
Methyl Methacrylate	.446	.030	6.7	.065	14.6	4.54×10^8

Attainment of cold flow was observed for all of the materials under test after long periods of time. This fact is highly significant, for it means that the cold flow rate is a straight-line function of the stress. The slopes of the time-deflection curves were measured after cold flow commenced, and plotted as a function of the stress to give *Fig.* 5.

TEMPERATURE: No results were available at the time of writing on the characteristics of the materials at different temperatures. Aside from the phenomenon of thermorecovery, already mentioned, also of note are the observations of Hetenyi, who pointed out that at temperatures of 110 degrees Cent., the phenol-aldehydic plastics behaved as true elastic materials. He emphasized also that the speed of deformation is greatly dependent upon the temperature.

As a basis of comparing the creep and cold flow characteristics of the materials, TABLE I has been prepared. Low ratio of plastic deformation to elastic deformation may be deemed desirable, as well as high values of the resistance coefficient.

Cold Flow Affected by Structure

EFFECT OF STRUCTURE: While insufficient types of the same materials were tested to permit a comprehensive analysis of the effect of molecular structure upon cold flow characteristics, a few results may be reported. For example, when laminated phenolics were baked at 275 degrees Fahr. for 24 hours and then tested under cold flow, a marked decrease was observed, indicating of course, that further polymerization had removed from the molecular structure some of those elements susceptible to plastic deformation. Tests upon hot molded phenolics which were prepared from more reactive phenolic constituents than employed in the preparation of the laminated materials, exhibited less creep and cold flow than the laminated.

Always a factor in determining the permanency of the physical properties of the plastics is the effect of temperature upon the shrinkage of the materials. This aftershrinkage occurs in addition to the normal thermal shrinkage of the material when it is removed from the mold. Failure to take it into consideration has sometimes caused serious discrepancies in design values. A few results are reported in *Figs.* 6 and 7.

A few remarks on the effects of moisture on the physical properties will serve to emphasize this important influence on the permanency of the characteristics. Much study has been given to the changes in physical dimensions of various organic plastics upon exposure to moisture. This consideration of permanency is of particular import when the molded articles are to operate in high humidity or in water. For example, laminated phenolic bearings operating in water must be designed with adequate shaft clearance to prevent seizure when the materials swell slightly in the course of time. The writer has conducted several tests in a highly humid atmosphere to illustrate the effects of high humidity upon dimensional stability of typical molded articles, *Figs.* 9 and 10. These data are given primarily for illustrative purposes, as no attempt was made to investigate thoroughly the question of moisture absorption. The designer is cautioned to make adequate allowance for swelling when the plastic parts are operated in water or high humidity. Particularly noteworthy is the more rapid permeation of moisture in cellulose than with the molded phenolics.

It must be emphasized once again that there are many factors affecting the permanency of the physical properties of plastics. This article has dealt with the fundamental aspects of one of the most significant factors, plastic deformation under stress. Further attention was called to other significant phenomena such as shrinkage at high temperatures, and swelling in moisture for various molded articles.

This article is another contribution by J. Delmonte, plastics authority, who has written the second book in the MACHINE DESIGN Series, *Plastics in Engineering.* Contents of this book will be announced early in 1940. Meaty and comprehensive, the volume will fill a long-felt need for a book on plastics aimed directly at the designer.

J. DELMONTE

Built-In Instruments

Accurate Control

By John W. Greve

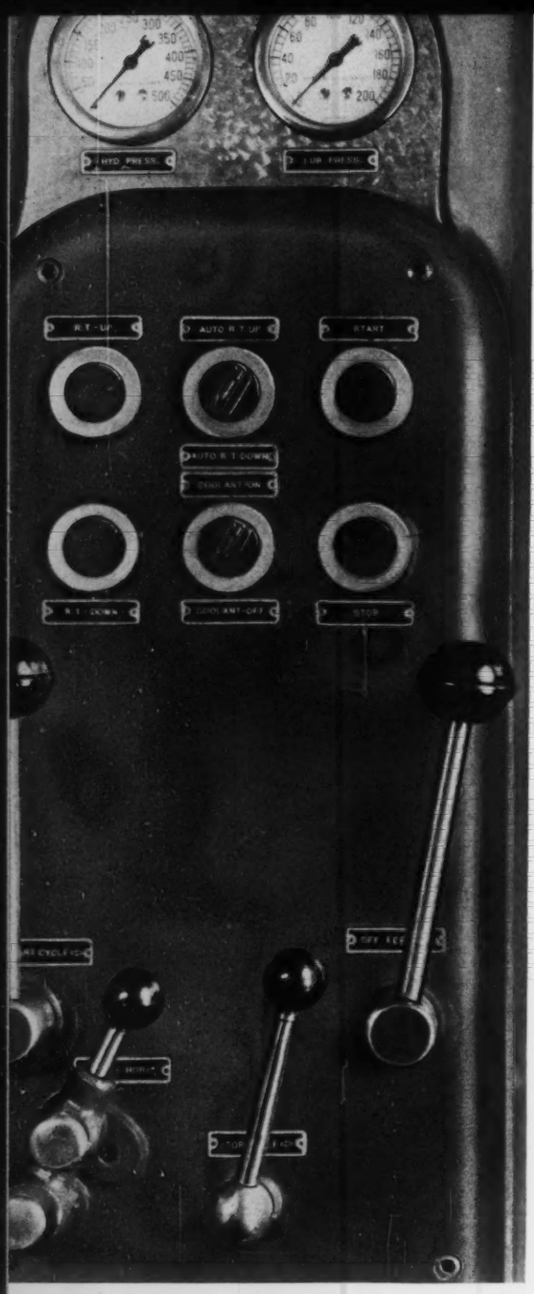


Fig. 1—Above—Conveniently arranged instruments show machine operation at a glance. Fig. 2—Below—Three instruments indicate oil pressures on automatic screw machine

INDICATING instruments are being built into machines both for greatest use in service as well as appearance. This precludes the tendency for a user to add refinements to a machine in the form of gadgets. Gadgets, as such, not only are often costly because of changes required for installation but frequently are a source of inconvenience and trouble at a later date.

Of course it is not always possible for a designer to anticipate a user's requirements or the uses to which a machine will be put. A primary consideration in design is to use the minimum number of parts for maximum use. Advantages of simplicity apply equally to instruments and to the machine itself. Otherwise, certain types of machines might easily become an impressive and forbidding array of instrumentation. Good applications of built-in instruments include only those which are economical for the majority of users. Obviously, instruments incorporated purely as a sales aid are uneconomical and not justified.

Present trends toward more accurate control of process, close specifications of quality and higher operating speeds of production machinery are making instruments increasingly useful and in many cases a necessity. Further, the conservative nature of most operators and old rule of thumb methods would be serious handicaps in training employes to take advantages of improved higher production methods without instruments to show operating conditions.

Instruments measuring hydraulic pressures are used to indicate many conditions of machine operation, such as pressure on chucks, feeds, clutches, lubricating systems, etc. For example, gages on the Barber-Colman hydraulic hobbing machine shown in *Fig.* 1 indicate hydraulic pressure in the automatic lubricating system and the working pressure in the hydraulic system for actuating hob carriage, clutches and work clamping device. Controls and gages are grouped together for maximum convenience to operator.

Three oil gages are used on the Cleveland automatic screw machine in *Fig.* 2 to protect the machine against possible damage from lubrication failure. The large instrument measures the pressure on the spraying system in the spindle head. Of the smaller two, one measures pressure to bearings and the other, pressure on an intermittent lubricating system for slides, ways, etc. Should one of the oiling systems fail, the machine will be protected by a shutdown. Provisions are made in the panel for a tachometer to indicate spindle speed. Since this machine is gear driven and speeds are shown by clutch settings, such an instrument would be useful only for checking.

ts Facilitate

Fig. 3—Pressure gage and two ammeters serve in control of induction machine for surface hardening

Previous examples are largely protective measures for the machine. Many instruments, however, serve to protect the workpiece as well. Indicative of refinements requiring close control of process to insure uniform results is the Tocco induction surface hardening machine shown in *Fig.* 3. This machine requires the application of a definite amount of heating for an accurately measured interval, followed immediately by water quenching. Although the process cycle is automatic, the operator has instruments to indicate proper functioning. A pressure gage in the left panel indicates the working pressure in the water line. In the right panel are two indicating ammeters of the thermocouple type. One indicates the amount of high frequency current and the other tells when the circuit is in tune much like a magic eye on a radio set. The former ammeter warns the operator against possible damage to the electrical system and the latter, when tuned to its maximum, tells when the machine is operating at its best.

Another useful application of ammeters is illustrated in *Fig.* 4 showing a Hanchett grinder. Here if the instrument indicates a load above normal, the grinding wheel is glazed and requires dressing. Otherwise continued operation besides being uneconomical would create heat and result in possible damage to the workpiece surface. Also, if any part of the machine should require attention such as lubrication, the additional load would be shown on the instrument.

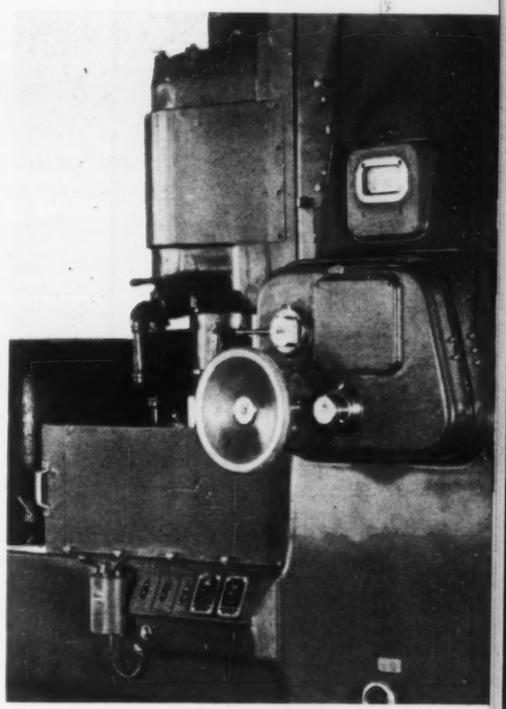


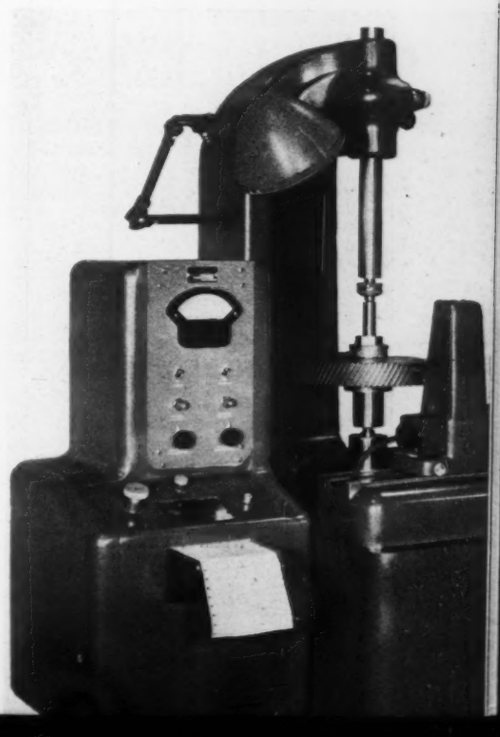
Fig. 4—Above—Protecting workpiece, ammeter warns operator when grinding wheel is glazed. Fig. 5—Below—Electrical instruments indicate and record errors in gear tooth form

Often, in addition to indicating instruments, recording instruments are required as for instance on the Fellows involute gear measuring machine in *Fig.* 5. In checking production gears for maximum deviation, the indicating instrument at the top of the panel is used, whereas for gears requiring a permanent record, the recording chart is utilized. This sensitive device operates electrically.

On hydraulic or friction drive machines, tachometers are almost essential when operating speeds must be controlled. Shown in *Fig.* 6 is a built-in speed indicator on a Continental Doall band saw. This instrument, located convenient to the speed change handwheel indicates the operating speed of the saw, the control of which is important to the precise cutting of metals. If an incorrect cutting speed is used, the saw will tend to burn up or operate inefficiently. On this machine the operating speed range is from 50 to 1500 feet per minute. For operator convenience a built-in dial informs the operator what saw thickness, pitch, temper and speed to use for various metals.

Another recently designed band saw includes an ammeter to indicate when the saw needs regrinding. Many operators have a tendency to use a saw beyond its useful period. However, with a careful maintenance schedule based upon the machine load shown on the ammeter an operator may actually increase his production even though saws are changed more frequently.

In *Fig.* 7 is illustrated the use of a single dial indicator in



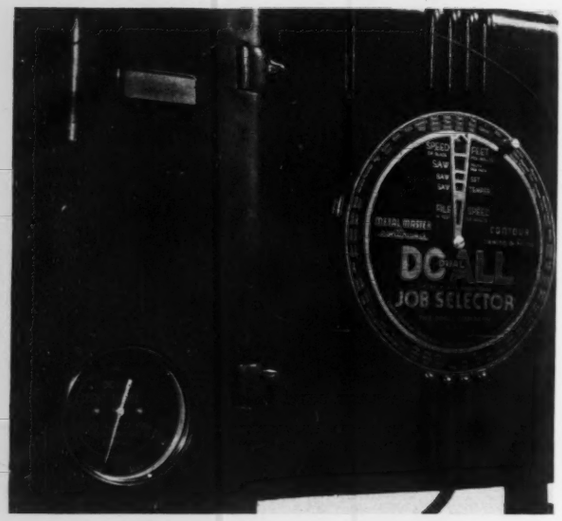


Fig. 6—Speed indicating instrument is important for best work on this friction drive bandsaw

the head of a Cincinnati milling machine. Used in conjunction with a four position turret stop this one instrument provides means for setting the cutter to the various steps. After the highest surface is milled, the turret stop is rotated to the next position and the head rapid traverse engaged. When the stop in the turret strikes a plunger in the feed unit, the rapid traverse is disengaged. The clutch is then manually advanced to its exact position as shown by the dial indicator for subsequent operations. Other applications of dial indicators include carriage stops on machine ways, traverse stops, etc.

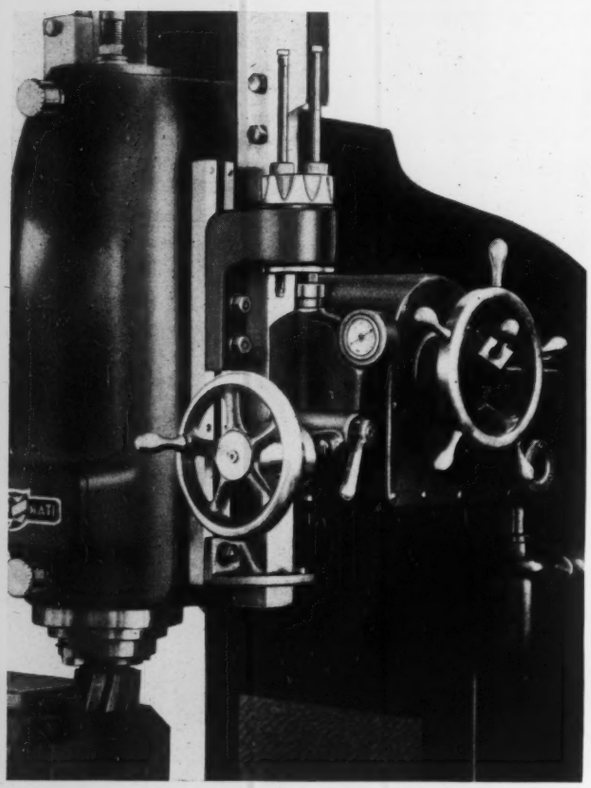


Fig. 7—One dial indicator serves for four settings when used with turret stop on milling machine

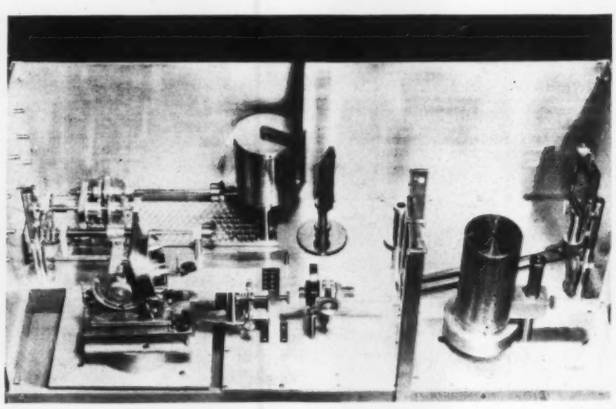
An interesting application of instruments is used on a foreign made radial drill press. A friction drive machine, it has three instruments built into the head which give the operator exact information on the conditions and operation of his machine. They indicate revolutions of spindle, rate of feed, and pressure of feed.

Countless other applications, where operator control of a machine is required, indicate the importance of this subject. Even as automobiles today are not considered dependable unless the driver can tell from instruments at a glance miles per hour, battery charging rate, motor temperature, oil pressure and amount of gas, general machines tomorrow will have built-in instruments as an accepted fact.

Light Beam Magnifies Surface Irregularities

INSTALLED in an air-conditioned room in the new Timken laboratory, this profilograph for checking surface finish is capable of 5000X vertical magnification.

A beam of light is projected through a slit and lens to a small mirror mounted at an angle on one end of a bell crank lever, the other end of the lever carrying a diamond point which rests on a specimen to test its precision. The specimen is mounted on a platform having rectilinear motion, this platform being connected through gearing to the recording drum. From the small mirror the beam of light is reflected to a series of three other mirrors to increase the length of



the light path, the beam being finally collected in a cylindrical lens and focused to a pinpoint on a sheet of sensitized paper mounted on the drum shown at the back of the panel.

The machine as set up in the illustration was developed at the University of Michigan. It is shown testing the finish on the inner race of a tapered roller bearing.

Improving Gear Materials with Nickel*

By C. M. Schwitter
International Nickel Co., Inc.

IN this day of "streamlined" machinery, the gears within the stylized housings are smooth running, long lasting and often carry loads formerly considered impossible. Three important factors have contributed to this progress. They are better design, improved materials, and revised methods of fabrication. Their inter-relation is such that it is impossible to discuss one without giving almost equal attention to the other two. It would not be reasonable, for instance, to alter the design of a gear without considering the advisability of a change in steel composition to meet the requirements of a revised stress analysis. It would be equally unreasonable to make an important change in fabricating methods without taking into account the machining qualities of the specified material and the nature of its response to heat treatment with respect to risk of distortion.

The reasons underlying the choice of any alloy steel for a specific application are two. The mechanical properties must of necessity be such that the gear will satisfactorily meet its service requirements. Equally important are fabricating properties which will insure economical machinability with adequate accuracy, and response to simple heat treatment with a minimum of distortion and freedom from cracking. Both of these considerations are dependent upon the costs involved. A high order of mechanical properties is an expensive luxury in gears subjected to light loads; freedom from distortion has no meaning if gears are fabricated from heat-treated bar stock.

Two types of alloy steels are generally used for gears, distinguished chiefly by their carbon content as carburizing or direct hardening. Nickel carburizing steels are used chiefly where exceptional toughness in the underlying core combined with the highest degree of wear resistant surface is required.

* *From a paper presented before the American Gear Manufacturers' Association.*

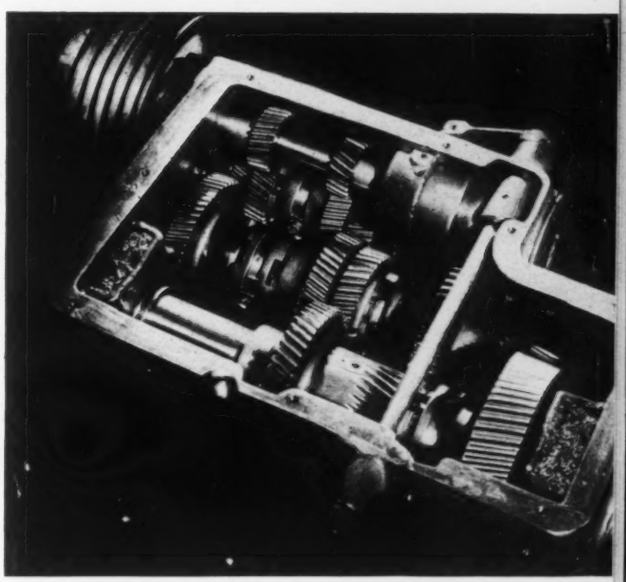


Fig. 1—High quality nickel alloy gears in lathe

Current design practice is often more concerned with compressive stresses developed on the engaging tooth surfaces than with actual strength of the teeth, particularly where high speed gears are involved. In TABLE I are listed the relative compressive stresses of various of the nickel carburizing steels

TABLE I

Permissible Compressive Stresses for Nickel Steels

Hardening Type	S. A. E. Classification	Compressive Stress Permissible, lb. per sq. in.
Direct	3150, 4640, 4650, etc.	170,000
Carburizing	3115, 3120	180,000
Carburizing	2315, 2320, 4615, 4620	200,000
Carburizing	3312, 4815, 4820, 2515	215,000

together with a value commonly used for the direct hardening types. These values are for intermittently loaded gears, and should be reduced by 20-25 per cent for constant mesh loading.

When compressive stresses, as calculated from the Hertz formula, do not exceed the figures given, the gear teeth are not over-stressed in compression and hence not likely to fail by pitting in service. This formula is

$$S_c = \sqrt{\frac{PE\,(1+\rho)}{1.75\,Df\,\sin 2\theta}}$$

where P is tangential force at the pitch circle, in

pounds; E, the modulus of elasticity of the gear material; ρ, the ratio between the numbers of teeth in gear and pinion; D, the pitch diameter of the gear, in inches; f, the face width, in inches; Θ, the pressure angle; Sc, the compressive stress in pounds per square inch.

Heavy duty applications are served best by the more highly alloyed types, such as "Krupp," S.A.E. 4815, 2515 and 4320 steels. Intermediate types are represented by S.A.E. 2315, 4615, and 3115, the latter being a particularly inexpensive, oil hardening steel offering considerable advantage in properties over ordinary carbon steel. When high core strengths are desired, it is customary to use these steels with a raised carbon content of .2 per cent, with sometimes the added advantage of better machinability in the annealed condition.

Double quenching treatments are seldom practiced commercially today, although such treatments have in the past been recognized as producing optimum properties in both case and core. To avoid the necessity for double treatment, steels which respond suitably to a simple quench are currently preferred.

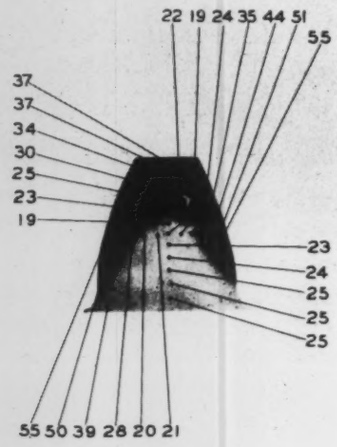


Fig. 2 — Flame hardened gear tooth showing rockwell hardness gradient from surface to center of core

Direct hardening nickel alloy steels provide greater core strength than the carburizing grades by virtue of their higher carbon content, but lack the peak wear resistance of the carburizing types. The surface hardness of the direct hardening steels is generally improved by the use of a cyanide bath for the heating medium, thereby forming a superficial, hard skin rarely exceeding .005 inch in depth. TABLE II lists the nickel alloy steels most generally used for direct hardening gears. Such values may provide basis for selection of a suitable composition for small or medium size gears, but by no means give an accurate picture for large gears.

Of the steels listed in TABLE II, S.A.E. 4640 and 3150 are generally used for automotive, bus and tractor transmission gears. S.A.E. 2350 is employed for high quality gears of small or medium section. Gears of this material are shown in *Fig.* 1. S.A.E. 3250, 3450, and 4340 are used for moderate and heavy-duty gears in which a high order of depth hardening properties is required.

Direct hardening steels permit wider choice of fabricating methods than do the carburizing types.

TABLE II

Properties of Direct Hardened Nickel Alloy Steels

S.A.E. No.	Draw Temperature to Produce 500 Brinell, °F.	Tensile Strength p.s.i.	Yield Point p.s.i.	Elong. in 2" Per Cent	Red. in Area, Per Cent	Izod Impact Ft. Lb.
2350....	550	255,000	228,000	11	38	13
3150....	450	255,000	228,000	7	25	7
3250....	510	260,000	230,000	9	34	9
3450....	480	260,000	235,000	11	42	11*
4340....	600	260,000	235,000	11	42	15
4640....	500	250,000	225,000	10	42	14

* Estimated.

The latter must be machined to fairly close tolerances prior to carburizing, after which the finishing operation is largely confined to grinding or lapping because of the high hardness of the case and the danger of losing too much of the useful structure if more than superficial surface layers are removed by the finishing operation. The direct hardening steels may be heat treated as bar stock and machined without further treatment, or they may be treated essentially as the carburizing steels and rough machined, heat treated, and finished. Hence machinability may be an important factor in the hardened state as well as prior to treatment, and distortion is important only when most or all of the machining is completed before heat treatment.

Any alloy steel which responds satisfactorily to direct hardening treatments should be capable of flame hardening. This process is in essence nothing more than the localized, progressive application of heat followed by a quench. The only major difference from a complete immersion type of treatment is the localized nature of the process, which produces severe strains that may handicap certain compositions.

There are three important considerations for flame hardened steels: First, hardenability; second, core properties; third, freedom from distortion and risk of cracking. Probably not enough emphasis has been placed upon the desirability of good core properties underlying the hardened zone. As in the carburizing steels, the core properties largely determine the strength and toughness of the teeth, while the hardened surface determines its resistance to wear and compression. In *Fig.* 2, a cross section of a tooth shows hardness gradient obtained from flame hardening.

Many gear and tool manufacturers have largely standardized on S.A.E. 4640 nickel-molybdenum steel for flame hardened parts. This steel shows very little distortion, and there is no difficulty in developing the required case hardness. The S.A.E. 3200, 3400, and 4300 steels have also enjoyed some popularity as flame hardening steels, and the process has even been ap-

plied to carburized S.A.E. 2300 and 3100 steels.

Nickel nitralloy which is essentially a regular nitriding steel containing 3½ per cent nickel, has also the advantage of being a precipitation hardening steel which develops in the core as a result of exposure to the nitriding temperature, a strength and hardness considerably in excess of its original properties. Indicative of what may be expected of this steel are the results of TABLE III. This steel can be machined to finished dimensions in a relatively soft state after suitable preliminary treatment consisting usually of normalizing, quenching, and a draw at 1200-1300 degrees Fahr. Nitriding treatment will then provide a wear resistant case of 950 to 1100 Vickers and automatically strengthen the core. The depth of the nitrided case will vary from .01 to .02-inch, depending on the time of the treatment. The precipitation-hardening characteristics of nickel nitralloy have

TABLE III

Properties of 3½% Nickel Nitralloy

Minimum Values Developed	Before Nitriding	After Nitriding
Yield Point, p.s.i.	120,000	160,000
Tensile Strength, p.s.i.	135,000	175,000
Elongation, per cent in 2 inches	14	13
Reduction of Area	45	40
Brinell Hardness (average)	286-321	375-400

also led to its utilization for gear applications in which a nitrided case is not desired.

Recent experiments with S.A.E. 4340 indicate that it lends itself satisfactorily to nitriding treatments. Standard practice is reported to produce a case hardness of 600 to 700 Vickers. The depth of case is presumably less than that obtainable with regular nitriding steels.

Cast iron gears differ from wrought alloy steels, in that cast iron may be more or less "tailored" to order. Typical compositions in which nickel is used largely to circumvent casting difficulties and promote machinability are shown in TABLE IV. None of these compositions is designed to produce high strength. All may be characterized as having good machin-

TABLE IV

Nickel Cast Irons for Light or Moderate Loads

Size of Gears	Section Thickness in Inches	A.S.T.M. Class No.	Typical Composition, Per Cent — T.C.	Si	Mn	Ni	Cr
Very small	¼-½	30	3.3-3.5	2.2-2.4	.55-.75	1.25	..
Small	½-1	35	3.2-3.4	1.4-1.6	.55-.75	1.25	..
Medium	1-2	35	3.2-3.4	1.3-1.5	.55-.75	1.5	..
Large	2-4	40	3 -3.2	1.3-1.5	.75-.95	1.5	.3

ability and wearing qualities. Their chief virtue is the possession of a uniform, dense-grained structure which has no tendency to be open or porous in the heavy section limits shown for each composition, nor to form localized clusters of carbides at edges and light sections. Chromium is often used in conjunction with nickel. This element strongly increases the chilling power of cast iron and hence neutralizes the effects of nickel and silicon in this respect. One part of chromium approximately balances one and one-half parts of silicon or three parts of nickel.

Cases have been reported in which manufacturers of large gears found that their cast-tooth gears possessed greater wear resistance than cut-tooth types, because the machining operation involved in preparation of the latter involved removal of sufficient surface material to expose a relatively soft, underlying structure. In such cases, solid blanks have been treated with a moderately increased amount of alloy to develop greater hardness at depth and thus provide reinforced wear resistance. A typical example of this

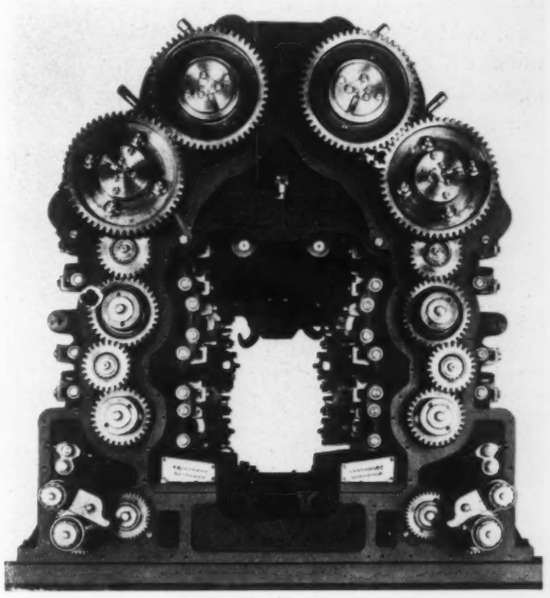


Fig. 3—Chromium nickel cast iron gears on newspaper press are wear resistant

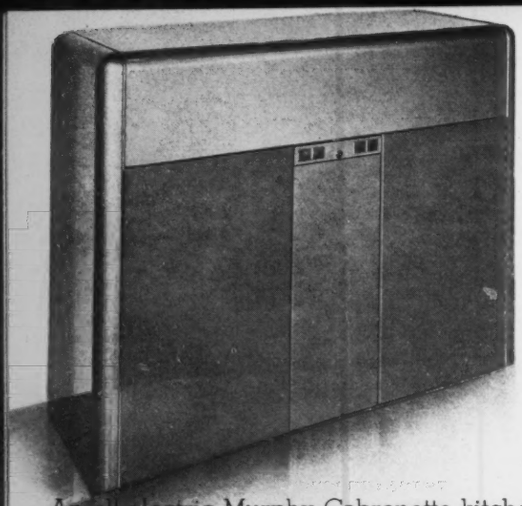
practice would be the modification of the large gear composition in TABLE IV to include .5 per cent chromium. An application typifying the use of nickel and chromium to provide a uniform, dense structure is illustrated by *Fig.* 3.

The machinability of cast iron may be roughly considered as inversely proportional to tensile strength, but there are many exceptions to this rule. Chief detriment to machinability is the formation of chill at the edges of a casting. Nickel additions to cast iron remove these chilled areas, promote structural uniformity, and make it possible to machine irons of higher hardness than plain irons with equal speeds, or at higher speeds for equal hardness.

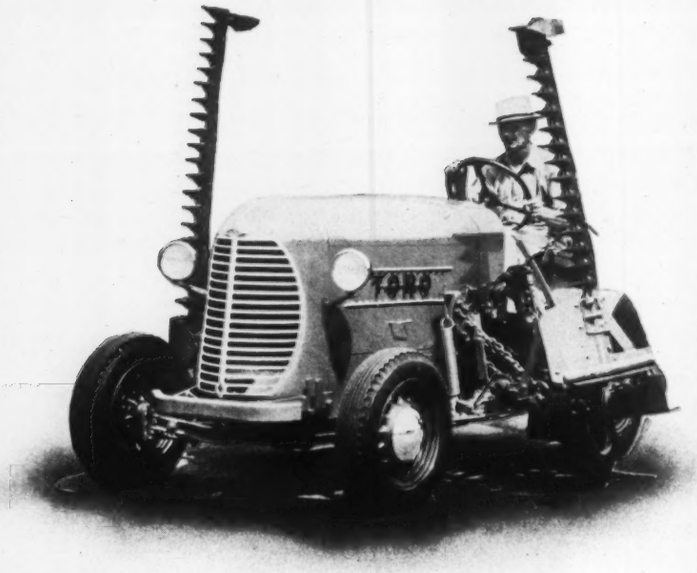
Typical nickel cast iron gear compositions for heavy-duty service are shown in TABLE V. The irons suggested for small, medium, and large gears have increased strength and better wear resistance than plain iron. The fourth iron is a high strength type.

Improved service properties do not always imply

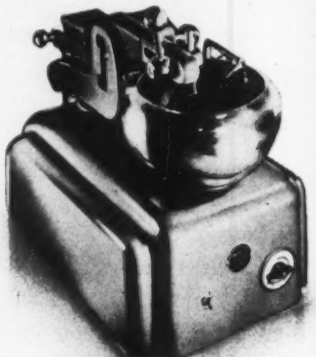
(*Continued on Page* 76)



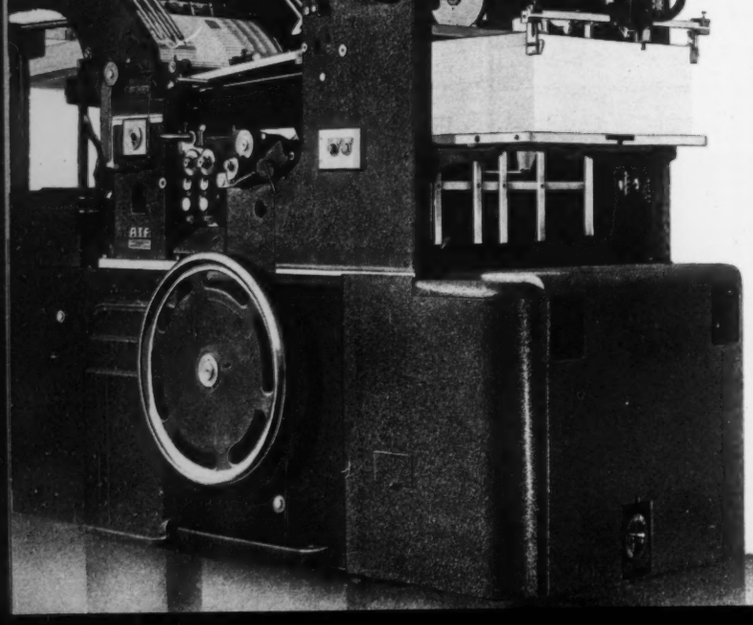
An all-electric Murphy Cabranette kitchen is concealed in the smooth exterior (above), obtained by flush, stainless steel tabs which open compartments at finger touch. The hermetically sealed Freon refrigerating unit may be withdrawn for service, being mounted on movable slides. Electrically interlocked switches prevent load from exceeding 1450 watts, regardless of switch positions



Toro highway grass mower (right above) is built around a Toro Bullet tractor with a six-cylinder engine and four-speed transmission providing traveling range from three to forty-five miles per hour. Application of sickle bars is novel in that they are entirely power-controlled. Bar on right side is driven by a takeoff from tractor transmission; bar on left side is driven by an independent air-cooled, single cylinder motor



Bowl feed lens polisher (right) is completely motorized, a quarter-horsepower double gear reduction motor housed in the base, furnishing power and simplifying the drive. As the bowl rotates, the polishing compound is thrown from the lap and is brought back in a continuous, regulated flow through a pipe. Completely automatic, this American Optical machine has an electric time switch. The lower spindle accepts conventional spherical laps, while the upper spindle operates with crank-pins and lens blocks



Easy access to cylinder and a quick-set feeder increase "get-away" of American Type Founders Clipper press (left). Adjustable drop-guides can be moved for delicate register changes without moving printing form, and sheets are completely visible at drop and side-guides during run. One plunge of a single-shot system forces oil to all main bearings. Entire inking mechanism is exposed when feed board is raised, making wash-up easier and faster. A substantial Kelly toggle device brings the cylinder down for a powerful, even impression

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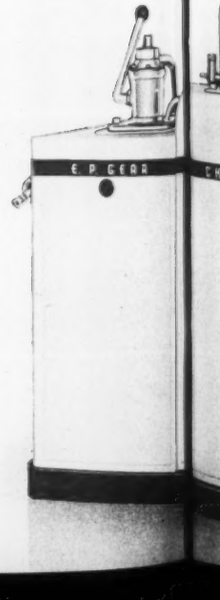

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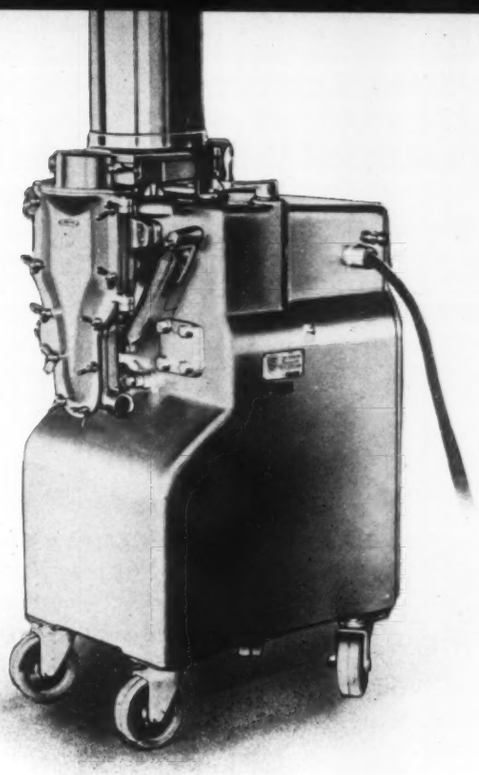
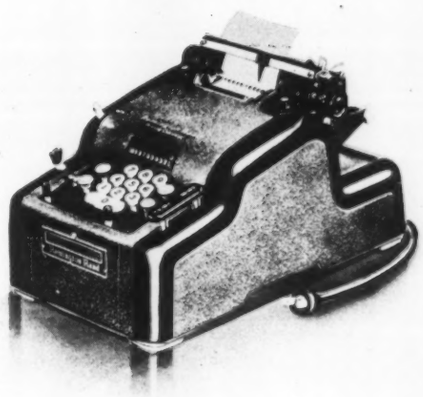


Complete and positive uniform distribution of light to the entire printing surface is given in the Bruning blueprinter (above) by a new Hanovia high pressure mercury vapor lamp, made of pure quartz. Operating life of 1000 hours is guaranteed, a sealed timer registering number of hours the lamp has burned. To protect operator from lamp glare, special switches on all parts giving access to the lamp shut off lamp if these parts are removed

rn Features ew Machines

Pres on of Recent Ma- m th dpoint of Design

new mac see page 96)



Heavy duty fruit feeder (left above) is principally nickel alloy, stainless steel and hard bronze, all wearing parts being readily accessible. Fruit is distributed by starwheel gravity feed into stream of ice cream, after which both are mixed by another starwheel in an enveloping chamber. Capacity is adjusted by variable speed drive

Electric multiplication and direct automatic division, with printed proof of all factors in every calculation, are performed on the Remington Rand printing calculator (left). Base of case is aluminum alloy. An instantaneous start and stop universal motor is used, which governs speed of the machine on its forward and return stroke. No oil governor is needed. Machine carriage is stationary

inet o portable multidrum lubricator (below)
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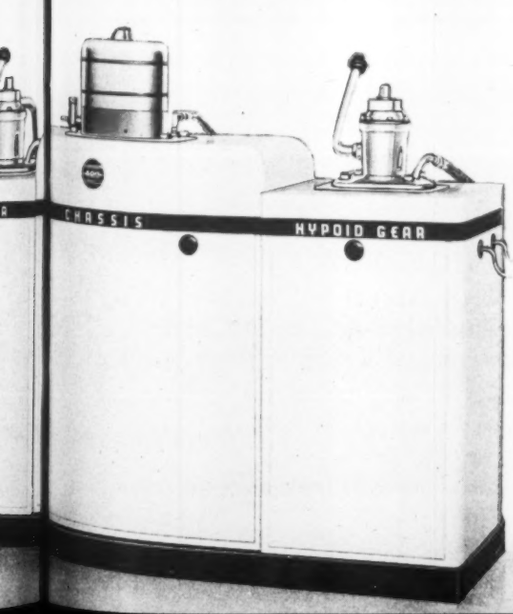
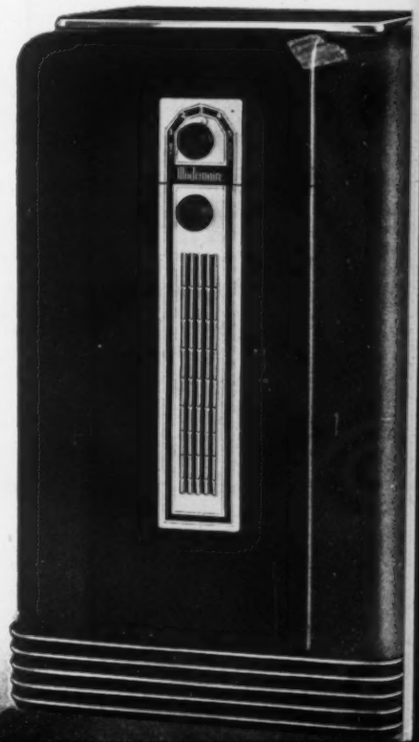


Containing a spring safety clutch and knob, a tamper-proof heat control valve in the Globe Modernaire oil heater (right) prevents accidental change in oil levels and flame height. Without moving parts, this heater employs convection for heat distribution. An automatic draft control maintains proper balance of air for good combustion, while a constant level safety oil valve assures smooth flow of fuel. Filter screen is located for easy cleaning. Stainless steel heat circulating grilles have been used effectively to aid appearance. The two-tone crinkle finish is baked on



MACHINE DESIGN Editorial

Increased Travel Should Be Possible with Better Business Conditions

COMPETITION that without doubt will ensue as a result of increased business tempo in 1940 will cast its reflection—as do all major changes—directly on the designer. Any easing of the purse strings of machinery manufacturing companies because of improved conditions ordinarily should permit more extended travel for members of the engineering staff. To offset this, however, more imperative calls on the time and energies of designers will tend to make mandatory the spending of every available minute "on the board."

Here is a case where chief engineers and designers again seem to be caught between two fires, and the question boils down to which procedure is best calculated to serve the interests of the machinery company. To our minds there is but one answer—increased travel.

A stay-at-home policy may work best in an emergency, but for how long should this continue? Just as a salesman necessarily must know every fine point regarding application of the parts or materials he is handling, so must a designer know the field his company is serving in developing its machines. And there is no better way of learning the intricacies of the field than by acquiring first-hand knowledge of it through visits to the plants in which the manufacturers' machines are installed. Actual operation in customers' factories more often than not reveals desirable refinements that are not apparent to the most analytical engineer during development at the plant of the machinery company —and "bugs" thus disclosed can readily be taken care of in later models.

It is those companies that pursue a policy of this nature—checking the machine from a design standpoint after installation—that are in the best position to improve their standing by capitalizing on information gathered in this way. Further, the viewpoint of a visiting chief engineer or designer is enlarged by every call he makes, thus helping him more fully to serve his organization and increase his prestige. The knowledge he gains of his specific field may well be utilized to supplement the overall design background he is able to obtain from visits to machinery expositions and engineering society meetings, from technical magazines, from books on design or from manufacturers' bulletins on commercial parts and materials, etc.

It may seem like a tall order to expect a designer to cover all this ground besides accomplishing his more conventional design work. The fact remains, however, that it is the wider vision and broader background thus acquired that enables him to perform his design assignments more speedily and with infinitely better judgment.

Professional Viewpoints

MACHINE DESIGN WELCOMES COMMENTS FROM READERS

" . . . end coils must be considered"

To the Editor:

REFERRING to Dr. Wahl's recent article in MACHINE DESIGN "Factors Affecting Accurate Spring Selection" I find one statement to which serious exception might be taken. It is stated that "for compression springs with squared and ground ends, as ordinarily formed, it is satisfactory in most cases to take the number of active coils as equal to the total number minus two." This allowance for inactive coils was a generally accepted basis of design for many years; but there is now a considerable body of evidence that it is too high.

Investigations by the ASME spring subcommittee's research program indicated an average value of 1.15 inactive coils as a deduction from *solid coils* (solid height divided by size of bar), equivalent to a deduction of 1.65 from total coils. Keysor, in an unpublished paper presented at the 1934 annual meeting of the ASME, announced a mathematical theory which gave 1.2 inactive coils.

Obviously, the importance of any error in the assumed value for inactive coils varies inversely as the number of *active* coils in the spring. In a spring of five solid coils, if the number of inactive coils is assumed to be 1.5 and the true value is 1.2, there will be an error of 0.3/4.8 or 6.25 per cent in the calculation, a rather serious matter.

—C. T. EDGERTON
New York

To the Editor:

THE writer would like to mention that the subject of end turns in helical springs referred to by Mr. Edgerton was discussed in more detail in the original manuscript of the paper. It is regretted that because of space limitations it was necessary to delete some of this material before publication.

The writer's statement regarding end turns was based mainly on the tests by Pletta, Smith, and Harrison. These tests were carefully carried out on a number of commercial springs using a test set-up designed especially for the purpose of determining the end turn effect. The results of the tests indicate that *at zero load,* the number of active turns was equal to n′ + ½ where n′ is the number of completely free coils at zero load. However, as the load increases the number of active coils was found to decrease, the amount of decrease varying from 0.5 to 1 turn at usual working loads, with an average of about 0.7 turn.

Since in our present discussion we are concerned primarily with the average number of active turns in the range from no load to working load (this value would be used in the deflection formula), it appears reasonable to subtract about half of the decrease from the number of active turns. This gives a figure for average active turns varying from n′ to n′ + ¼. Because, for these springs, the number of total turns was n′ + 2, the active turns found in the tests varied from about 1¾ to 2 with an average of perhaps 1.85, the higher values being found for the higher loads. These figures compare with a value of 1.65 as reported by Mr. Edgerton, and theoretical values of 1.5 and 1.7 reported by Vogt and Keysor respectively, all figures being referred to total turns. Therefore the writer agrees with Mr. Edgerton that the figure of 2 suggested in his paper is probably slightly high for most cases. Before suggesting a definite value, it would seem desirable to carry out further tests. On the basis of present knowledge probably a figure of 1¾ would be as good as any for average conditions, although it is a little low when compared with the results of Professor Pletta's tests. For springs subject to rather high loading, the tests also indicate that a value of 2 would yield the best results.

Mr. Edgerton's comments are appreciated, particularly with respect to the results obtained in the course of the research carried out by the Committee on Mechanical Springs. The writer agrees with Mr. Edgerton in that where the number of active coils is small, accurate evaluation of end turn effect is important.

—A. M. WAHL
East Pittsburgh

" . . . . covered important points"

To the Editor:

I HAVE gone over "How Hardening and Temperature Affect Steel" abstracted from my A.S.M. paper and published in your November issue. You have covered the important points of the paper very well indeed and it is hoped that the presentation of this data in your publication will provide useful information for the design engineer.

—S. W. LYON
Urbana, Ill.

Men of Machines

J. B. SANDO

J. B. Sando, who recently has become associated with the Western Laundry Machinery Co., North Kansas City, Mo., as chief engineer, brings to his new duties broad knowledge of every type of laundry and dry cleaning machinery. His past eighteen years have been applied exclusively to research, development and improvement of all types of equipment for commercial laundries and dry cleaning plants.

Mr. Sando is a graduate of the Massachusetts Institute of Technology. The early years of his professional career were devoted to the design of centrifugal and other forms of hydraulic machinery. In his new connection as chief engineer of the Western Laundry Machinery Co., he has assumed the responsibility for carrying out a comprehensive program of expansion.

LESTER M. GOLDSMITH

AWARD of the Melville medal by the American Society of Mechanical Engineers this year was made to Lester M. Goldsmith, chief engineer of the Atlantic Refining Co. This medal is given for original work on any mechanical engineering subject presented to the society.

A native of Pennsylvania, Mr. Goldsmith is a graduate of the Drexel Institute of Technology. In 1914, he entered the employ of Atlantic Refining Co., as a mechanical draftsman. Subsequently he served as experimental engineer, engineer of tests, technical assistant to the president, and consulting engineer. He was appointed manager of the company's general engineering and construction department in 1934, and three years later was made chief engineer. Mr. Goldsmith is a member of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

JOHN E. LOVELY

IN his new position as president of the National Machine Tool Builders' Association, John E. Lovely, vice president, Jones & Lamson Machine Co., Springfield, Vt., will find invaluable his extensive experience in the various branches of the machinery building field, from designing to sales.

Upon graduating from the University of Vermont, he was employed by the F. R. Patch Mfg. Co. from 1910-1916, the last few years of which he was chief engineer. There he was engaged in designing, manufacturing and selling various types of machines manufactured by the company. During the last year of his connection with this organization he supervised the manufacture of shells and the designing and building of special purpose shell-making machines. Later he was engaged in building special machinery and shells, at Fort Dearborn Mfg. Co., and Vermont Farm Machine Co.,

(*Concluded on Page* 74)

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NOTEWORTHY PATENTS

Safety Stop Precludes Accidents

FOR machines requiring positive operation during one cycle only to insure safety in operation such as for paper cutting machines, a safety mechanism has been designed by Freeman Barney. Assigned to the Challenge Machinery Co. and covered by patent 2,171,841, this device renders a machine

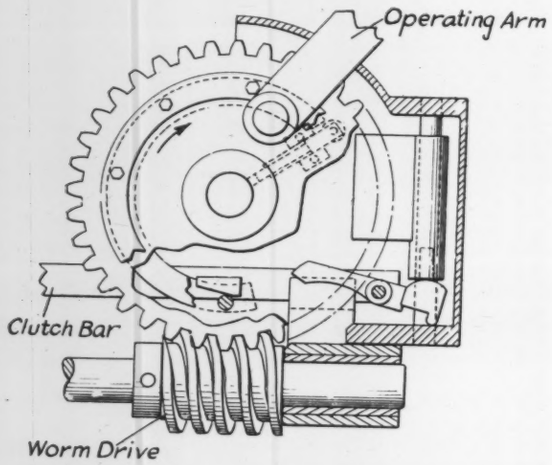


Fig. 1—Safety drive mechanism disengages clutch automatically after each operation

inoperative after one operating cycle until the operator re-engages the initiating controls. Regardless of whether the operator accidentally holds the clutch in engaged position or a part of the mechanism fails, this safety device will prevent subsequent operations.

Illustrated in *Fig.* 1 are the protective features of this design. When clutch is engaged the clutch bar shown moves to the right. Near the completion of one revolution a pin comes in contact with a block on the clutch bar returning the latter to disconnect the clutch and apply the brake.

If some part of the normal declutching operation should fail to function, for example, the operator holding the clutch lever in engaged position, the pin striking the block and breaking, or the clutch freezing and there not being a disconnection of power, a lever at the end of the clutch bar being depressed by a ring on the gear retains a vertical vane turned toward the gear. Further rotation beyond the cycle engages a roller with the vane and forces a pin toward the center. This disconnects the operating wheel from the ring gear permitting the driving members to freewheel. Operating conditions are restored by rotation backward until spring-return pin re-enters its slot.

Torque and Speed Govern Ratio

DEPENDENT on conditions of torque and speed for drive ratio, the variable drive illustrated in *Fig.* 2 automatically adjusts itself to the load conditions of the system. Designed by Lester E. Perrine and assigned to General Motors Corp. this drive covered by patent 2,168,744 has been developed for use in automobiles.

A series of endless belts with variable diameter pulleys controlled by a torque-cam device, speed governor and helical spring on the driving shaft as well as similar spring and cam devices on the driven member comprise this transmission. All the control parts are so selected that belts remain taut at all times.

In the drawing the pulleys of the driving member are expanded to give the smallest belt diameter and the greatest torque. As the drive shaft revolves, cam members on the torque device shown at the left move axially after the torque load exceeds the force on the preloaded springs in the device. This movement causes the pulley diameters to increase with corresponding reduction in those on the driven member. With increasing speeds the speed governor weight moves outwardly and further increases the pulley diameter to effect overdrive.

Increasing loads reverses the action of the system and provides higher torques. Control of cam angle on the torque devices provides braking action from the motor when brakes are applied. However if throttle were suddenly closed, the dash pot on the torque device of the driving member would prevent a sudden change in pulley diameter.

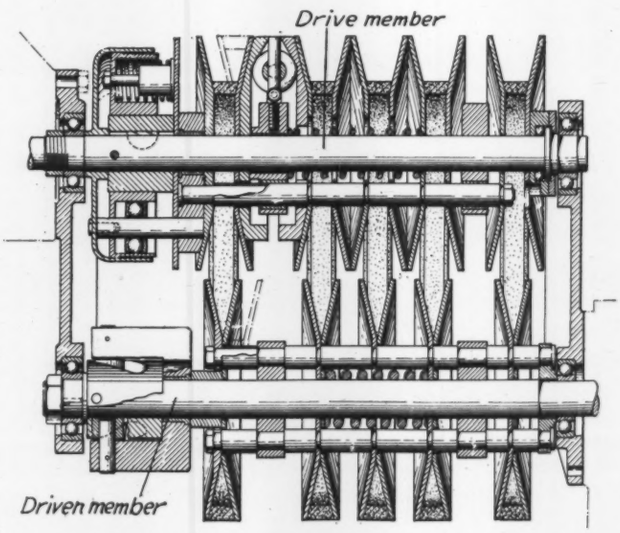


Fig. 2—Automatic transmission changes speed ratio according to speed and torque

Thumbs up!

New Westinghouse Push Buttons...save space...stop fumbling ...improve appearance!

It's a unanimous "thumbs up" sign of approval that machine operators give the new Westinghouse Type SD push button.

Its large buttons are easier to operate . . . its shrouded design and optional safety latch protect machine and operator from accidental operation . . . and its compact, modern design is tops in appearance!

For any control circuit application . . . for any type of mounting . . . you'll be interested in the added convenience and appearance that Type SD push buttons offer. Write for the new bulletin describing them—bulletin 15-020.

ROTARY SELECTOR SWITCHES

Rotary selector switches provide an optional type of control station with the same modern lines and appearance as the new Westinghouse push buttons.

ENCLOSURES FOR EXPOSED LOCATIONS

Dust and watertight enclosures, where desired, make Type SD push button units available for outdoor or exposed locations.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Dept. 7-N.

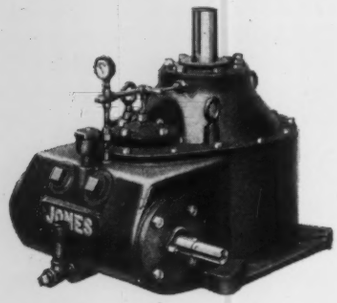
J-20883

Westinghouse *Type SD* Push Buttons

New PARTS AND MATERIALS

Reducers Have 15 Standard Ratios

FOR continuous operation coupled direct to electric motors, a new line of worm-helical speed reducers is announced by W. A. Jones Foundry & Machine Co., 4401 Roosevelt road, Chicago. Each of the ten sizes in the line has 15 standard ratios ranging from about 40 to 1 to approximately 250 to 1, for all the common motor speeds and horsepower ratings. Each unit is supplied with an oil pump for providing lubrication to the bearings in the housing cover as well as for the helical gears, this feature permitting performance under constant loads at motor speeds with moderate operating temperature conditions. Steel worms are case hardened and ground on all principal diameters as well as on the worm threads. The accurately generated worm gears are chill cast nickel alloy bronze. Helical pinions integral with their respective shafts are heat treated nickel steel while low speed helical gears are manganese alloy cast steel, heat treated. All shafts are mounted in ample capacity roller bearings.



Each of ten sizes in line of speed reducers has numerous ratios for all common motor speeds and horsepower ratings

Clad Plate Improves Steel Resistance

TO IMPROVE corrosion resistance of carbon-molybdenum steel and still retain its desirable characteristics of good creep strength, ready weldability and comparatively low cost, Croloy bonded plate has been developed by Babcock & Wilcox Co., New York. Essentially the plate includes thin sheets of chromium stainless steel (carbon .08, chromium 11 to 14, molybdenum .4 to .6 per cent) continuous resistance welded to a base plate of carbon-molybdenum steel (carbon .1 to .2, manganese .3 to .6, molybdenum .45 to .65 per cent). Welding is done by individual spot welds that overlap lengthwise and crosswise on the plate. Uniformity and permanence of the bond is assured by using two or more sheets of the chromium steel with a sheet of nickel interposed between them and the base plate. This construction provides the electrical resistance necessary for the generation of welding heat by increasing the number of contacts between the electrodes and the base metal. The fact the bonded plate can be subjected to high temperature without deterioration permits heat treatment after welding is completed. Tests have shown the bonded plate will stand any necessary fabrication without difficulty.

Bearings Have Impregnated Retainers

BALL bearings incorporating retainers made of oil-impregnated bronze for specialized applications are announced by Fafnir Bearing Co., New Britain, Conn. Holding and slowly feeding sufficient oil to lubricate the bearing through its life, this type retainer is ideal for applications that are inaccessible or subject to sub-zero temperatures. Fabricated from a strong, die-pressed bronze, the retainer's porous structure forms a reservoir for the retention of as much as 25 per cent of its volume of oil. The microscopic pockets hold the oil and also maintain the oil film between the ball surfaces and the retainer pockets. In sub-zero applications where even light grease will harden, these bearings provide a minimum of drag.

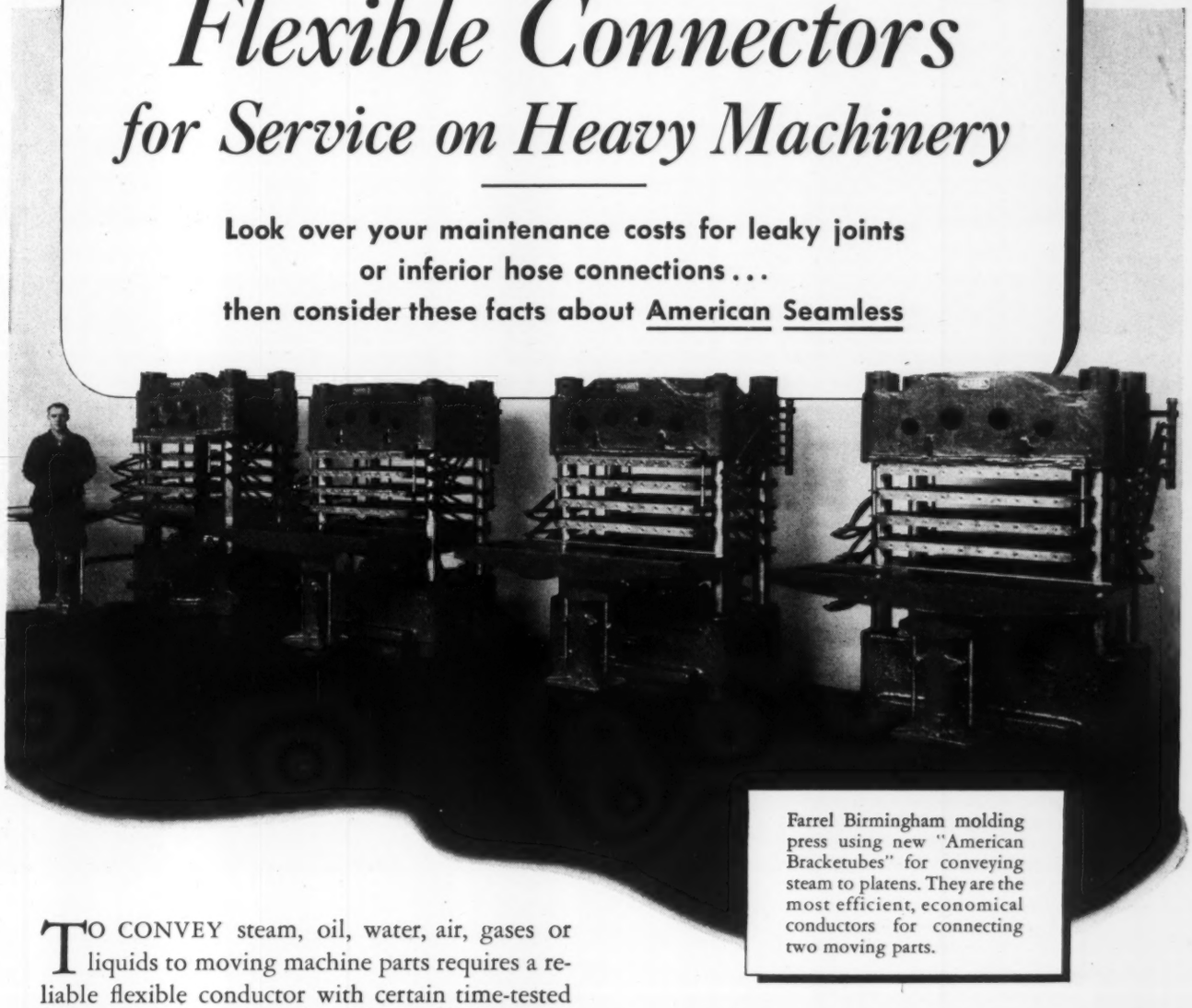
Valve Control for Air Cylinders

A NEW valve designed for semiautomatic control, full automatic control or remote control of double-acting air cylinders is announced by the Ross Operating Valve Co., Detroit. The valve, fully air-operated, is actuated by pilot controls and these pilots are made in various designs to meet the immediate control demands, for hand, foot or mechanical action with a push, cam, toggle or other desired movement. This system is said to be especially well suited to problems calling for a series

Valve for control of double-acting air cylinders is actuated by pilot controls of various designs to meet different demands

Flexible Connectors
for Service on Heavy Machinery

Look over your maintenance costs for leaky joints or inferior hose connections . . . then consider these facts about American Seamless



Farrel Birmingham molding press using new "American Bracketubes" for conveying steam to platens. They are the most efficient, economical conductors for connecting two moving parts.

TO CONVEY steam, oil, water, air, gases or liquids to moving machine parts requires a reliable flexible conductor with certain time-tested qualities. To avoid production shutdowns and delays, you can't take a chance on second rate articles. So, why not consider these exclusive advantages and properties of American Seamless Flexible Metal Tubing:

1. American Seamless is *flexible metal tubing* made from *seamless tubes* of various workable metals. It has no joints, welds, seams or packing of any kind.

2. In tests made in independent laboratories with several different types of installations, American Seamless has flexed back and forth literally millions of times without showing signs of failure.

3. Reinforcing metal braid increases this flexible tubing's ability to withstand elevated pressures—for example, 1/2" I. D. with two braids tests to a hydrostatic bursting pressure of 5,000 lbs. per sq. in.

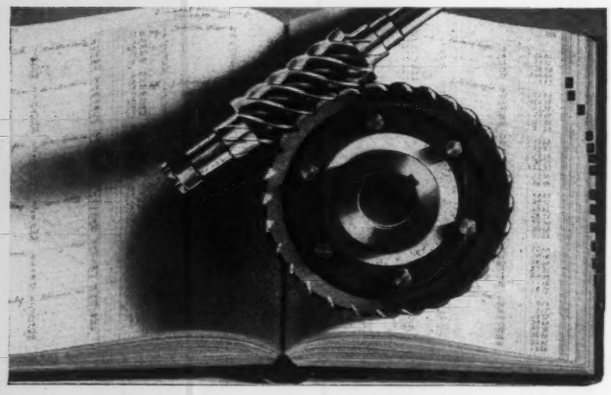
The details of this and other valuable engineering information are in a new 24-page manual. Illustrations show typical installations; diagrams accompany installation instructions. There are complete data charts covering sizes, bursting pressures, and bending diameters. Write for your copy now. It will help you to bring about new economies on your conductor-connectors. 39248

ANACONDA
from mine to consumer

American Metal Hose

The American Metal Hose Branch of The American Brass Company, General Offices: Waterbury, Connecticut

In Canada: Anaconda American Brass Ltd., New Toronto, Ontario • Subsidiary of Anaconda Copper Mining Company



Clevelands Make the Machines You Build, Pay Back Faster . . . Because

THEY OUTLIVE THE BOOKKEEPER

● Accurately-kept performance records *prove* that Cleveland Worm Gear Speed Reducers make machines pay back faster—by delivering power reliably, regardless of shock load, during every hour that machines operate.

In more than 20 major industries, equipment of many types driven by Cleveland Worm Gear Speed Reducers has continued in full operation through 12, 15 or even more years, with no need for repair or parts replacement on the Drive Units.

Have you a reference copy of the Cleveland Worm Gear Catalog in your files? Elaborate engineering data and clear, interesting illustrations provide valuable help in drawing worm gear drive specifications.

Cleveland District Representatives will gladly call for consultation with your own Engineers relative to the correct applications—whether standard or special—of Cleveland Worm Gear Drives to the machines you build. The Cleveland Worm & Gear Company, 3275 East 80th St., Cleveland, Ohio.

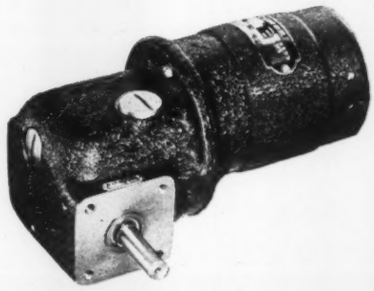
Affiliate: The Farval Corporation, Cleveland, Manufacturers of Centralized Systems of Lubrication

CLEVELAND WORM GEAR Speed Reducers

of successive operations demanding rapid and accurately timed progressive movements.

Mounting Features Motor

TYPE KD, a double-reduction geared motor with an armature shaft output rating of 1/10-horsepower at 7000 revolutions per minute is announced by Dumore Co., Racine, Wis. Within the cast iron housing finished in black crinkle enamel, the motor is mounted by means of a machined face, a pilot boss and four tapped holes around the output shaft. This feature provides great rigidity for the transmission

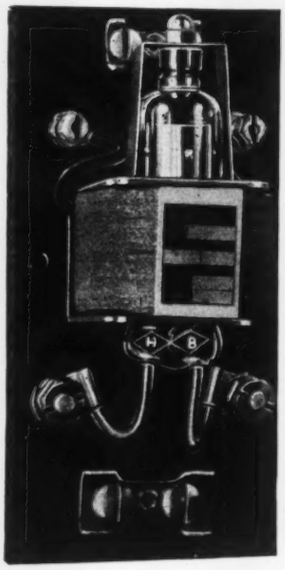


Great rigidity for high torque transmission is provided in geared motor by mounting which includes machined face, pilot boss and four tapped holes

of high torque. Composition bronze bearings are used throughout and gearing is worm type with hardened steel worms functioning with a plastic gear in the first stage and a hardened steel gear in the second gear. The output shaft may be brought out horizontally to the left or parallel to the armature shaft as desired.

Mercury Displacement Operates Relay

DESIGNED to operate in any position within 45 degrees of the vertical, a new mercury plunger relay is announced by H-B Electric Co. Inc., 2507



When solenoid coil is energized, plunger in mercury relay displaces mercury and floods contact, closing circuit

North Broad street, Philadelphia. The plunger within the glass tube is pulled downward when the

IT'S THE DRIVE YOU USE THAT MAKES THE DIFFERENCE

Two Yards At A Bite Without Indigestion

● Back of the steel dipper teeth of giant power shovels is tremendous power—engine power that is transmitted unfailingly and efficiently by—*roller chain drives.*

Power shovels perform no namby-pamby job under carefully protected and coddled conditions. . . . They are put to work on big construction projects, on dam sites, levees, mountain roads—in the tropics or arctics—often far away from handy service.

Diamond Roller Chains for years have proved their worth and stamina in such brawny work, they are regularly used by leading manufacturers of excavating and construction machinery, yet are equally adaptable for the average drive, low, medium or high speeds, and for the finest and most precise applications... Catalog and engineering data book on request. DIAMOND CHAIN & MFG. CO., 435 Kentucky Avenue, Indianapolis, Ind. *Offices and Distributors in All Principal Cities.*

IT'S THE DRIVE YOU USE THAT MAKES THE DIFFERENCE

YOU DON'T HAVE TO GAMBLE on SPRING QUALITY and SERVICE

Just say

ACCURATE

and BE SURE!

A COMPLETE line of mechanical springs, wire forms and stampings—for any purpose—of any material.

Ask our Engineering Department to help you with your problems.

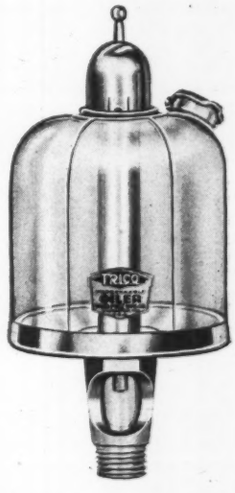
Write today for your copy of the new Accurate Handbook — It's free to executives and engineers.

ACCURATE SPRING MANUFACTURING CO.
3813 West Lake Street • Chicago, Illinois

solenoid coil surrounding the tube is energized, this action displacing the mercury in the tube and flooding the contact, thus closing the circuit. When the coil is de-energized, the plunger immediately floats to the top of the mercury, opening the circuit instantly. The design holds the arc center, shielded by the action of the plunger around an internal ceramic cup, where the make and break occurs.

Oiler Lubricates Automatically

A NEW line of visible gravity feed oilers with unbreakable reservoirs is announced by the Trico Fuse Mfg. Co., Milwaukee. The oiler, illustrated, is mounted at the top of the part to be lubricated and a predetermined number of drops of oil per minute obtained by a simple adjustment of the ratchet control. This oiler is 50 per cent lighter in weight and there are no gaskets to leak as the unbreakable bottle is cemented and roll-clinched to the heavy brass base. All metal parts are bright cadmium-plated for beauty and easy cleaning. The oiler is equipped with dual ratchet springs and a heavy tension ring which fits over the ratchet springs, this construction assuring uniform pressure on the ratchet feed and preventing change of the adjustment through extreme vibration or careless handling. These oilers come in three styles, in one, two, four and eight-ounce capacities.



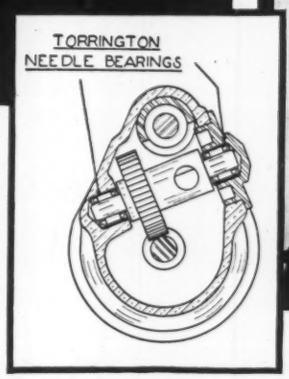
A predetermined number of oil drops per minute is obtained by adjustment of ratchet control on line of visible gravity feed oilers

Thermostatic Controls Announced

TWO thermostatic control units, F-101 and F-102, for built-in machine applications are announced by Guardian Electric Mfg. Co., Chicago. Compactness is indicated by the dimensions: F-101 is 1½ inches wide by 2 inches long by 1½ inches high and is designed to permit adjustment, if necessary, after the machine it controls is in service. F-102 is ⅜-inch wide by 2⅛ inches long by 2 inches high with preset adjustment before installation. Both units have

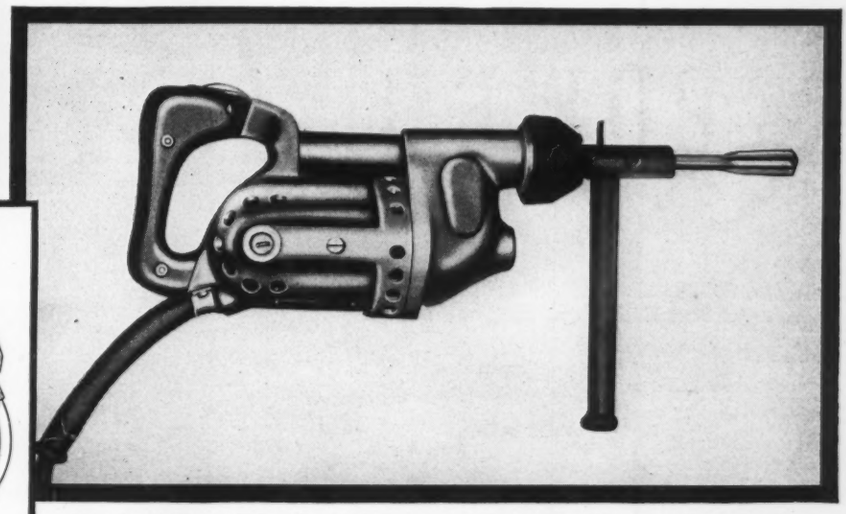
"WE GET BETTER LUBRICATION ON TOUGH JOBS WITH THE TORRINGTON NEEDLE BEARING"

SAY MAKERS OF WODACK ELECTRIC TOOLS



(*Above*) Wodack engineers designed the Wizard Electric Hammer for ruggedness, light weight and ability to run long periods without servicing

(*Right*) Cross-section showing how the Needle Bearings are mounted on the trip pin spindle.



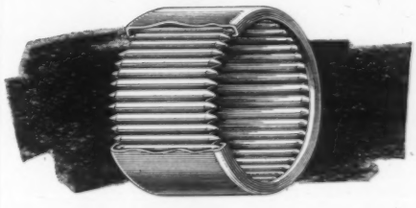
The light, high-speed Wizard Electric Hammer in which two sets of Torrington Needle Bearings transmitted 576,000,000 pounds of energy without additional lubrication—and with no signs of wear.

FOR their light-weight, hard-hitting Wizard Electric Hammer, engineers of the Wodack Electric Tool Corporation selected the Torrington Needle Bearing. In addition to small size and high unit capacity they secured a third important advantage—*better, longer lasting lubrication.* But read their own report . . .

"A stock Wizard Hammer was operated for 100 hours continuously day and night without additional lubrication on any of the working parts. Upon its disassembly, it was found that the bearings showed no signs of wear and appeared as good as new.

"The plunger strikes 2,400 times per minute, which is 144,000 times per hour. Therefore, in the 100-hour test, this part operated 14,400,000 times. At each actuation a blow of 40 pounds was struck, which totals 576,000,000 pounds of energy developed during this test period. *All of this energy passed through the two Torrington bearings, which are mounted on the trip pin spindle that operates the plunger.*

"Inasmuch as a certain amount of heat is developed during a test run of this nature, several of the parts were about to run out of lubrication. *However, the*



Torrington bearings with their unique characteristic of retaining lubricant were in very good condition." (Italics are ours).

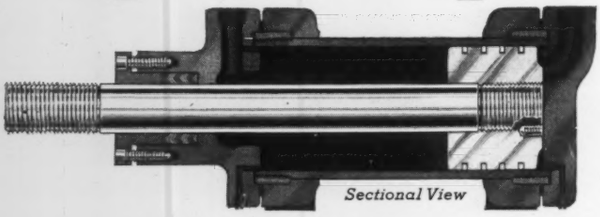
And that is not all. The Needle Bearing is an inexpensive, easily-installed, compact unit that makes recognizable savings on assembly costs. Let the Torrington Engineering Department tell you more about this and perhaps suggest ways in which the Needle Bearing can give you exclusive advantages.

For further information write for Catalog No. 9. For Needle Bearings to be used in heavier service, request Booklet 103X from our associate, the Bantam Bearings Corporation, South Bend, Ind.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.
Makers of Ball and Needle Bearings
New York Boston Philadelphia Detroit
Cleveland Chicago London, England

TORRINGTON
NEEDLE BEARING

LESS
Fluid Slip
MORE
POWER



Sectional View

● All Hannifin patented high pressure hydraulic cylinders undergo routine fluid-slip tests at 1000 lbs. per sq. in. pressure. Achievement of minimum fluid slip, with the resulting high efficiency performance in service, is based on the exclusive Hannifin design.

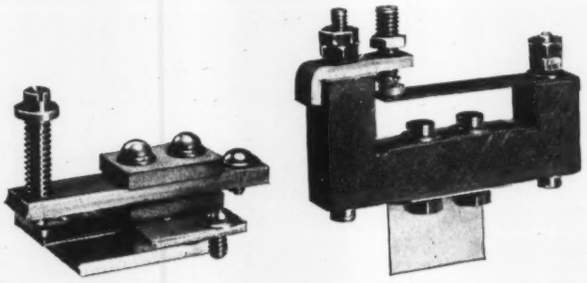
Note these features: *No tie rods.* End caps may be removed without collapse of other parts. *Universal end caps.* May be positioned independently, with inlet port at top, bottom, or either side, and moved without disturbing mounting. *Air vent plugs.* Each cap has air vents on three sides. *Leakproof.* Special mirror finish honing produces a straight, round, perfectly smooth cylinder bore, affording perfect piston seal and minimum fluid slip.

Hannifin high-efficiency hydraulic cylinders are built in six standard mountings, with small diameter piston rod, 2 to 1 differential piston rod, or double end piston rod, in all sizes, for working pressures up to 1000 and 1500 lbs. per sq. in. Furnished with or without cushion. Other types built to order, any size, for any pressure. Write for Bulletin 34-MD with complete specifications.

HANNIFIN MANUFACTURING COMPANY
621-631 South Kolmar Avenue, Chicago, Illinois
Engineers • Designers • Manufacturers
Pneumatic and Hydraulic Production Tool Equipment

HANNIFIN
HYDRAULIC CYLINDERS

screw-type adjustment. Special ceramic separators fired under high temperature and not subject to shrinkage are used. Contact points are fine silver while thermostatic strips are high grade. Both units are furnished in either of two temperature ranges, from low heat control for any desired temperature

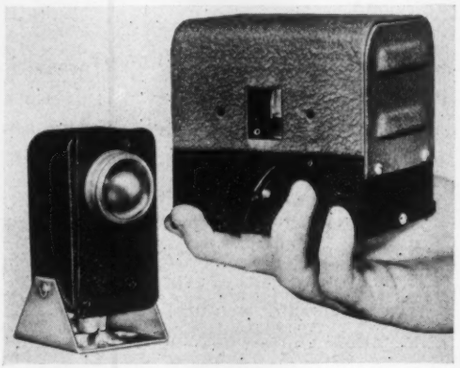


Furnished in two temperature ranges with possible accuracy of not over 2 degrees variation, two thermostatic control units are on market

ranging between 110 and 180 degrees Fahr., and for high heat control between 250 and 360 degrees Fahr. Although supplied with an accuracy of plus or minus 5 degrees, the thermostatic controls can be adjusted for not over 2 degrees variation.

Announce Photoelectric Control

OPERATING on 110-volt, 60-cycle alternating current only, a small photoelectrical control is announced by United Cinephone Corp., 43 Rawson street, Long Island City, N. Y. Current supply of



Current supply to the light source of small photoelectrical control comes from transformer within the control

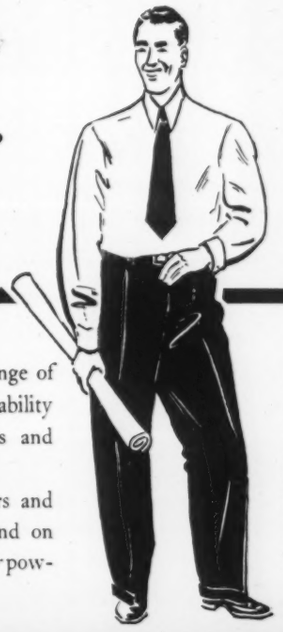
6 volts to the light source comes from the transformer within the control. The power relay is designed for 3 amperes, noninductive loads.

Handwheel Controls Speed Changes

SPEED changes on the improved variable speed drive announced by U. S. Electrical Motors Inc., Los Angeles, are effected by turning the hand wheel which shifts the motor on the base. The yoke which actuates the pulleys for the multiple belt is then

"WHITNEY CHAINS

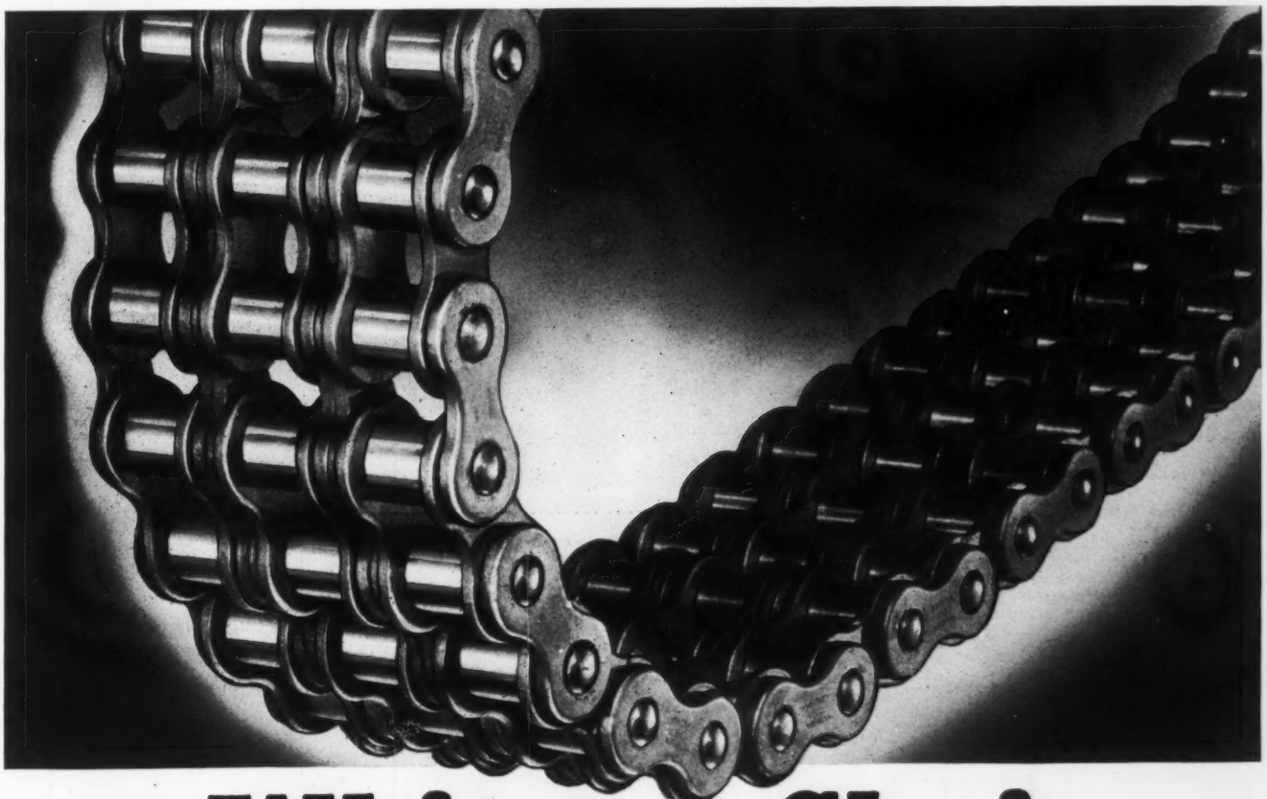
Fitted Into Our Plans...



...and Solved the Whole Power Drive Problem"

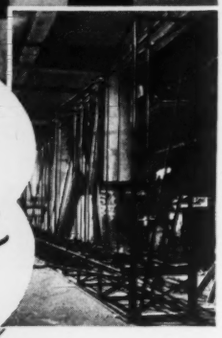
"When you figure power drives in terms of Whitney Chains, the job often becomes a lot easier. For Whitney's complete line provides the flexibility to fit into most all design requirements... offers a wide range of drive selections ... plus adaptability to varying .service conditions and special applications."

Scores of machine designers and builders have learned to depend on Whitney for the answers to *their* power drive problems. And they have learned, too, that Whitney Chains protect their products' reputations by maintaining full machine capacity under toughest service conditions. Have *you* a copy of the Whitney Roller Chain Catalog? Write today.

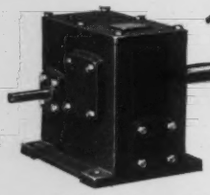


Whitney Chains

THE WHITNEY CHAIN & MFG. CO., HARTFORD, CONN.



KEEPING THINGS MOVING AT *Macy's*



R. H. MACY & CO. of New York saluted the opening of the New York World's Fair with their entire Broadway storefront of six windows converted into a moving panorama of previous World Fairs.

Designed by Irving Eldredge, display manager of R. H. Macy & Co., these window backgrounds consisted of a group of eight prisms on which the scenes were painted. These trylons turned simultaneously to reveal a second panorama. The third side extends a greeting to each of the forty-eight states.

The Bliss Display Corporation, who built the entire installation, used a large type D3 Ohio gear reducer to turn three mechanisms in each group of windows simultaneously. The three mechanisms connected by a Universal jointed shaft over sixty feet long developed a torque of 1500 inch pounds. So successful has been the appeal of these windows, that they have remained throughout the entire season, an unprecedented event in department store window promotions and proof of the value of ACTION in display.

You'll find the advantages of Ohio Gears and Reducers well suited to your transmission needs also. Write for complete catalog today.

THE OHIO GEAR CO.

1338 E. 179th Street • Cleveland, Ohio

Representatives

*New York City, N. Y.
Patron Transmission Co.,
454-456 Grand Street

*Los Angeles, Calif.
J. W. Minder Chain & Gear Co.
927 Santa Fe Avenue

Grand Rapids, Mich.
W. H. Slaughter,
419 Oakdale St., S. E.

*Pittsburgh, Pa.
Standard Machinists & Supply Co.
South 2nd and McKean Street

Detroit, Mich.
George P. Coulter
322 Curtiss Building

Buffalo, N. Y.
F. E. Allen, Inc., 2665 Main St.

*Kansas City, Mo.
Kansas City Rubber & Belting Co.
712 Delaware Street

*San Francisco, Calif.
Adam-Hill Co.
244-246 Ninth St.

New England George G. Pragst
260 Esten Ave., Pawtucket, R. I.

Louisville, Ky.
Alfred Halliday, 330 Starks Bldg.

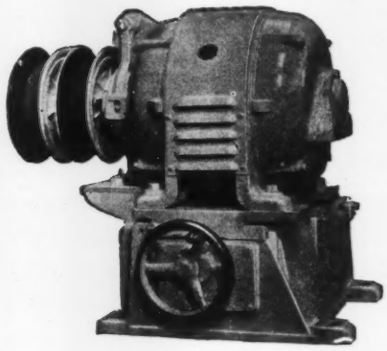
*Indianapolis, Ind.
A. R. Young
518 North Delaware Street

St. Louis, Mo.
St. Louis Tool Co.,
2319 N. Ninth Street

*Stocks carried.

OHIO GEARS

moved. A new lubrication system provides a thorough method of greasing the pulley sliding fits, a hollow section of shaft passing through the pulleys and the grease being ejected through orifices from the hollow section to the sliding surfaces. The end



Handwheel shifts motor on base, changing pulley yoke, to effect speed changes on variable speed motor

of the motor shaft is also equipped with a grease fitting. Sets of ways on the motor mounting base and the main unit base are accurately machined and thus correct alignment is assured and a rigid sliding support for the motor attained.

Announce Circuit Breakers

PRODUCTION of the new 2-pole, 100-ampere, type M2 Multi-breakeR is announced by the Square D Co., Detroit. The M2 breaker is common trip, that is, overload on one pole automatically trips both poles simultaneously. The breaker cannot be held closed on

Common trip Multi-breakeR cannot be held closed on a short circuit or on an overload

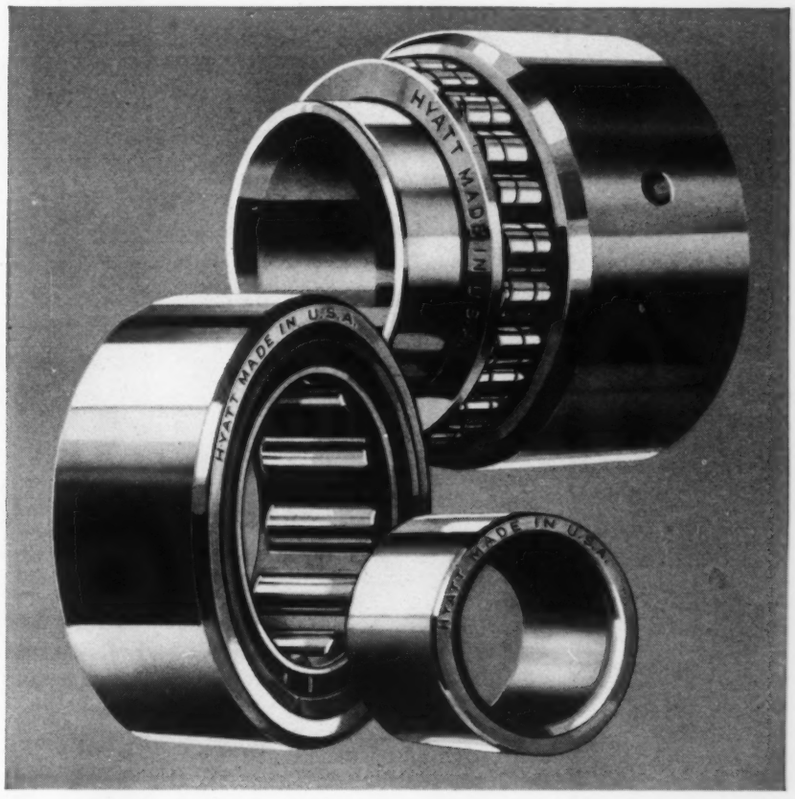
a short circuit or overload. Whether the unit is on, off or tripped is shown clearly by the indicating handle. These breakers are tamper-proof, factory calibrated and sealed so the intended and proper capacity cannot be exceeded.

Rotary Pumps May Be Direct Driven

RUNNING quietly at high speeds and under pressures up to 500 pounds per square inch, new series 500 rotary geared pumps for hydraulic installations are announced by Brown & Sharpe Mfg. Co., Providence, R. I. Their speed characteristics

Where the Going is Heavy

GO HEAVY ON HYATTS



HYATT WOUND ROLLER TYPE and HY-LOAD SOLID ROLLER BEARINGS shown opposite. Inherent design advantages, uniformity and accuracy along with their capacity for heavy loads accounts for the widespread application of these better bearings.

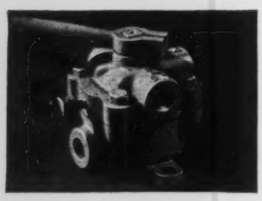
Built for heavy going, Hyatt Roller Bearings ask for no soft jobs. And not only do Hyatts help keep equipment in perfect running order while new, but continue to give uninterrupted performance for life of the equipment. Therefore, in considering bearing applications, here's something worth remembering for machine builder and user alike: to keep bearing wear and care out, always put Hyatts in! Hyatt Bearings Division, General Motors Sales Corporation, Harrison, New Jersey; Detroit, Chicago, Pittsburgh and San Francisco.

HYATT *Roller* BEARINGS

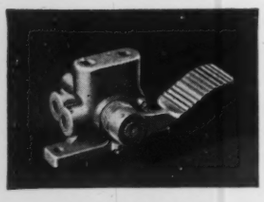
NOPAK VALVES for Every Air Control Problem

- Positive Control thru Finger-Touch operation
- Quick or Throttling Action as desired
- No Air Loss thru Valve Leakage
- No Valve Packing to Replace
- No Valve Maintenance or Service Costs.

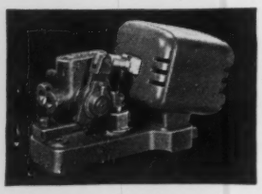
...enable you to build these SALES FEATURES into your MACHINES



3 and 4-Way Hand Operated Valve



3 and 4-Way Foot Operated Valve with Spring "Return"



NOPAK Solenoid Valve, 3 and 4-Way, with Push Button Control

The NOPAK *packless principle* and *patented rotating disc construction* make these features *yours* at no extra cost. Air pressure against the valve disc, at all times, keeps lapped surfaces of disc and seat positively sealed, permits finger-touch operation, and prevents injury of sealing surfaces from grit or other foreign matter. The result is a leakproof valve with sealing surfaces that actually improve with use.

The packless, leakproof valve-stem assembly eliminates all packing replacements, gland-nut adjustments, maintenance or service requirements.

NOPAK Valves for Air or Hydraulic control are made in a wide range of standard sizes and models to meet practically all design applications. For detailed descriptions and technical data, write for Illustrated Valve Bulletin, No. 65.

NOPAK Air Cylinders

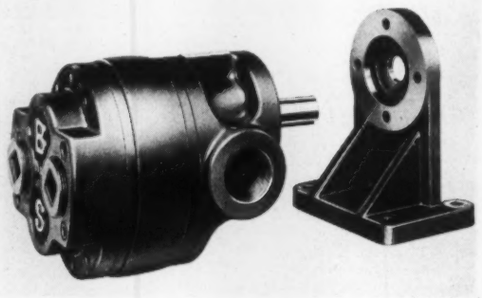
—are Cushioned Air Cylinders—with Adjustable Cushion-Heads for close regulation of cushion-effect . . . or with the new type Self-Regulating Cushion Head. The latter sell in the same price range as non-cushioned cylinders.

GALLAND-HENNING MFG. CO.

2752 South 31st Street • Milwaukee, Wisconsin

NOPAK VALVES and CYLINDERS

permit these pumps to be direct motor driven. The pumps are compact for their respective capacities and the flanged stand with the separate foot-type mounting bracket meets satisfactorily almost every mounting condition. This design also facilitates the assembly of duplex and motor drive units, two different flange sizes covering the entire range of six pumps. Materials for parts are carefully selected for the service requirements. Made separate from shafts, the herringbone gears are heat treated steel and the shafts are carefully hardened alloy steel. Thrust plates, cap stand and housing are close grained, cast iron.



Speed characteristics of new series of rotary geared pumps with herringbone gears permits them to be direct connected

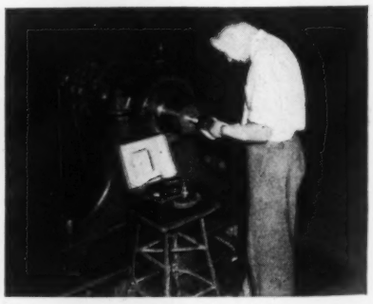
Heavy Beads Increase Pulley Life

A REDESIGNED line of V-belt pulleys with extra heavy bead and heavier side walls which increase pulley life is announced by Congress Tool & Die Co., 9030 Lumpkin avenue, Detroit. Diamond bored, these pulleys eliminate belt adjustment after each speed change because center distance remains constant when changing belts.

Engineering Dept. Equipment

Instrument Measures Unbalance

FOR use wherever rotating masses require balancing to eliminate vibration, a portable dynamic balancing instrument is announced by General Electric Co., Schenectady, N. Y. Self-contained, this precision instrument is capable of measuring the amount

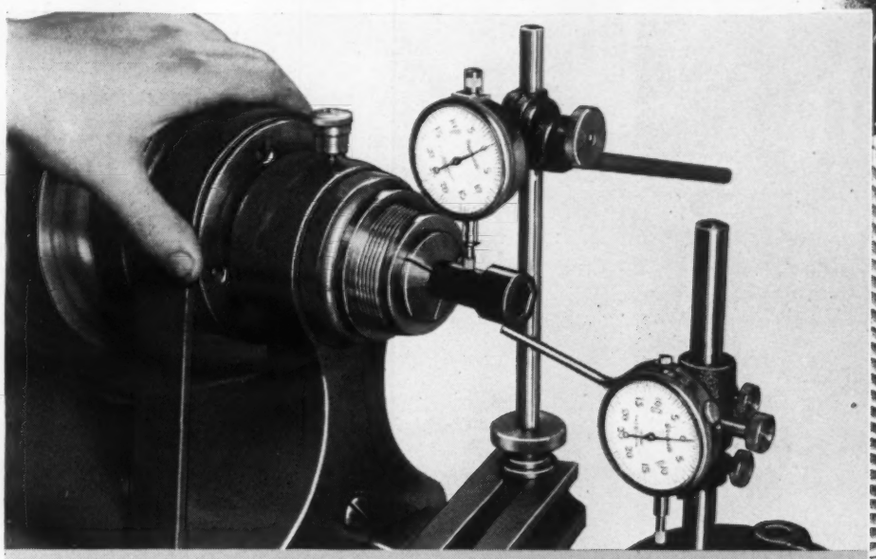


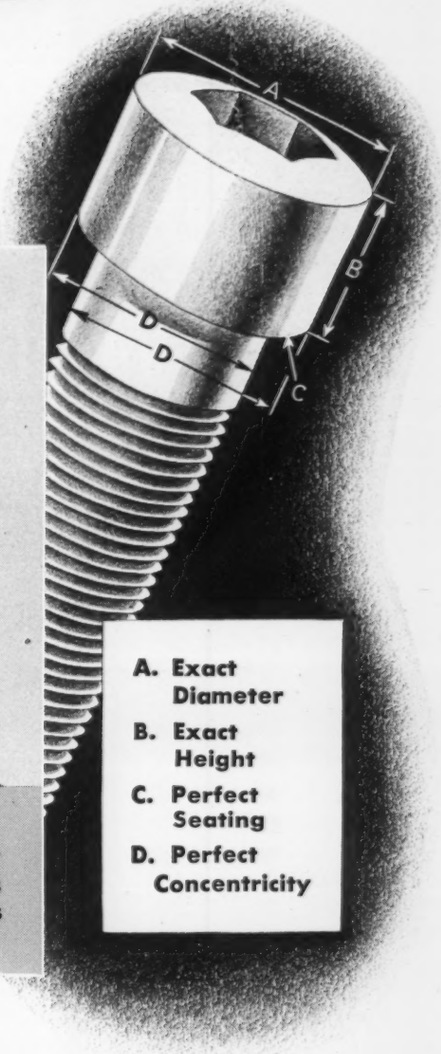
Portable dynamic balancing instrument checks amount and phase angle of unbalance vibration in rotating masses

THIS FOUR-WAY CHECK

Rules out "HEAD-aches"

FOR USERS OF PARKER-KALON SOCKET SCREWS





PRECISE CONTROL OF HEAD DIMENSIONS

Perfect seating of socket screws in counterbores is assured by this head-to-body concentricity test in Parker-Kalon's laboratory. Uniformly accurate head heights and diameters are guaranteed by other tests --- all to save you difficulties.

"16 POINT QUALITY-CONTROL" Leads Critical Buyers to Demand PARKER-KALON

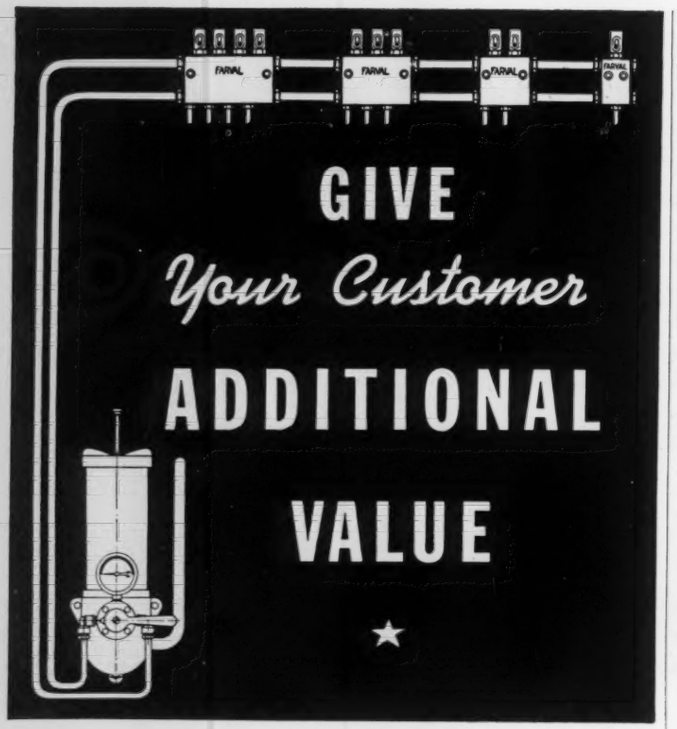
Head Dimension Tests are only one part of the 16-check routine on important characteristics of Parker-Kalon Cold-forged Socket Screws. In a laboratory without counterpart in the industry, quality is guarded by tests and inspections covering:

1—Chemical Analysis. 2—Tensile Strength. 3—Ductility. 4—Torsional Strength. 5—Ability to take Shock Loads under Tension. 6—Resistance to Shock Loads under Shear. 7—Hardness. In addition, there is a rigid inspection of these essentials: 8—Head Diameter. 9—Head Height. 10—Concentricity of Head to Body. 11 — Socket Shape. 12 — Socket Size. 13—Socket Depth. 14—Centricality of Socket. 15—Class 3 Fit Threads. 16—Clean Starting Threads.

In this way Parker-Kalon maintains a new higher standard of quality in Socket Screws . . . a standard that satisfies critical buyers. Send for free samples . . . see for yourself.

PARKER-KALON CORPORATION, 212 Varick Street, New York, N. Y.

PARKER-KALON *Cold-Forged* **SOCKET SCREWS**



BY INSTALLING Farval Centralized Systems of Lubrication you will extend the useful life of the equipment you build, thus increasing the value of your customer's investment. Farval Systems guard every bearing against burning-out or undue wear due to improper lubrication, and insure continuous production.

The Farval System is a mechanical method of delivering clean lubricant from a central station under high pressure to a group of bearings, in exact, measured quantities. Operation is constant and positive, regardless of the number of bearings in the system, *and not a bearing is missed.*

In addition, Farval will lower consumption of power; reduce consumption of lubricant; eliminate the labor of oiling and prolong the life of your equipment.

Farval can be applied at your own or your customer's plant. A Farval Engineer will gladly show you how readily the System can be adapted to your particular type of equipment. The Farval Corporation, 3265 East 80th Street, Cleveland, O.

Affiliate of the Cleveland Worm & Gear Company . . . Automotive and Industrial Worm Gearing . . . In Canada: Peacock Brothers Limited

FARVAL

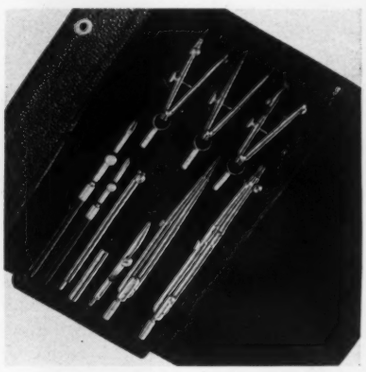
CENTRALIZED SYSTEM OF LUBRICATION

Special Delivery to Every Bearing

and phase angle of unbalance vibration present in the bearing pedestals of a rotating machine running in its own or substitute bearings at any speed between about 600 and 5000 revolutions per minute. Because the correct balance is made under operating conditions this equipment improves the quality of the result, as the changes effected by load and by the foundations are included. Balancing is permitted without removal of the rotor from the machine. The complete equipment, packed in a single case with no batteries or external power source required, consists of a sine-wave alternator, a vibration pickup and an instrument with its associated circuit on which mils displacement of the vibration are read.

American Drawing Instruments

AMERICAN made drawing instruments called "Minusa," (contraction of "Made in U.S.A.") are now in production by Keuffel & Esser Co., Hoboken, N. J. They have a slender "rounded taper" construction, designed to produce excellent balance and a maximum of strength. Use of a special hard-rolled nickel silver stock lends unusual rigidity to compasses, dividers and springbows. For the present these instruments, with the exception of the large ruling pen, will be produced and offered in complete sets only.



Slender rounded taper construction of American-made drawing instruments is designed to give balance and strength

Machine Blueprints in One Minute

PRODUCING perfect blueprints or direct process prints in one minute or less, the "Minute Man" portable blueprint machine is announced by Paramount Engineering Co., 5707 West Lake street, Chicago. The machine is automatically controlled by an electric timer so that anyone can operate it and it can be placed on a desk or anywhere in an office or engineering department. Print paper and tracing are wrapped around an 8-inch diameter by 19-inch length clear cylinder and held tight against the cylinder by a preshrunk cover. Two No. 2 photoflood light bulbs mounted horizontally to give uniform light intensity provide the light source.

HERE'S HOW WE ENGINEERED

1. FOR LOWER OPERATING COSTS
2. FOR MODERN POWER APPLICATION
3. FOR GREATER PRODUCT SALABILITY

● You could say the very same thing about your machines after you had included Link-Belt power transmission equipment, because you would get these results. Link-Belt anti-friction and babbitted bearing transmission units, clutches, couplings, collars, take-ups, gears, etc., and a full line of positive drives—silent and roller chain drives, speed reducers and variable speed transmissions, give you modern, dependable, low-cost ways of solving transmission problems. Our engineers, with experience in every type of power transmission equipment application, are ready to help you at your call. Send for 272-page Engineering Data Book No. 1600.

LINK-BELT COMPANY

Chicago Indianapolis Philadelphia Atlanta San Francisco
Toronto Offices in principal cities 7878

LINK-BELT POWER TRANSMISSION EQUIPMENT

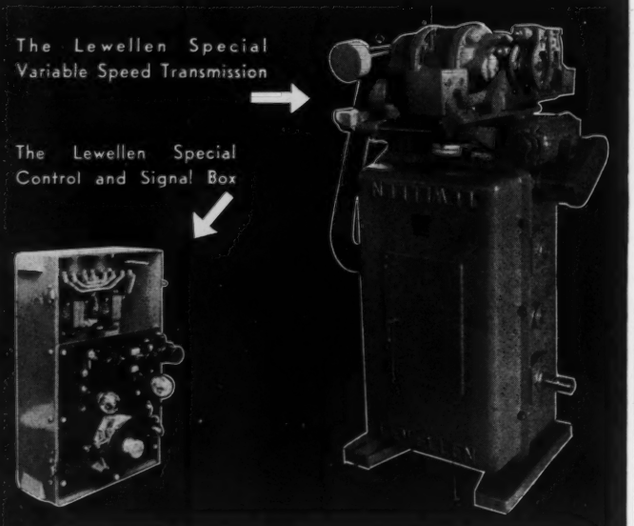
PROBLEM

The Case of Maintaining Uniform Tension in Winding Strip Metal

from the files of Lewellen Engineers

SOLUTION: *A specially designed Lewellen Variable Speed Transmission with Automatic Control (illustrated below).*

RESULT: The winding reel starts at its highest speed. As the strip of material on the spool increases in diameter, the control accurately reduces the speed of the reel to maintain uniform tension on the strip as it is wound. *Now, get this!* After the reel has filled and the unit stopped for removing and replacing it with a new core, the control *reverses its position* to allow the new reel to start again at the maximum speed and decrease in speed as it is filled.



THIS PROBLEM is one of hundreds that come to Lewellen each year. Lewellen Engineers are constantly finding better ways to control production machines profitably. Often, results are *amazing.*

You appreciate the importance of the proper application of modern speed control to your production machines. *So, why not call a Lewellen Engineer today?* Whether your needs are small or large, the vast experience acquired by Lewellen Engineers over a period of more than 40 years is yours for the asking.

LEWELLEN MANUFACTURING CO., COLUMBUS, INDIANA

Lewellen knows speed control

•

LEWELLEN

Variable Speed { TRANSMISSIONS MOTOR PULLEYS

Meetings and Expositions

Dec. 4-8—

American Society of Agricultural Engineers. Fall meeting to be held at Stevens hotel, Chicago. Raymond Olney, St. Joseph, Mich., is secretary.

Dec. 8-9—

National Standard Parts association. Annual meeting and exhibition to be held at Sherman hotel. E. P. Chalfant, 1420 United Artists building, Detroit, is executive vice president.

Dec. 9—

Eastern Photoelasticity conference. Tenth semiannual meeting to be held at Cambridge, Mass., under the auspices of the department of mechanical engineering, Massachusetts Institute of Technology. Additional information may be received from W. M. Murray, Room 1-321, Massachusetts Institute of Technology.

Dec. 12—

Motor and Equipment Manufacturers association. Annual meeting to be held at Blackstone hotel, Chicago. Additional information may be obtained from the association headquarters, 250 West Fifty-seventh street, New York.

Jan. 16-18—

American Society of Refrigerating Engineers. Thirty-fifth annual meeting to be held at Blackstone hotel, Chicago. David L. Fiske, 37 West Thirty-ninth street, New York, is secretary.

Jan. 22-26—

American Society of Heating and Ventilating Engineers. Sixth International Heating and Ventilating exposition and forty-sixth annual meeting of the society to be held at Lakeside Hall, Cleveland. Exposition will be under direction of Charles F. Roth, Manager, International Exposition Co., Grand Central Palace, New York.

Jan. 22-26—

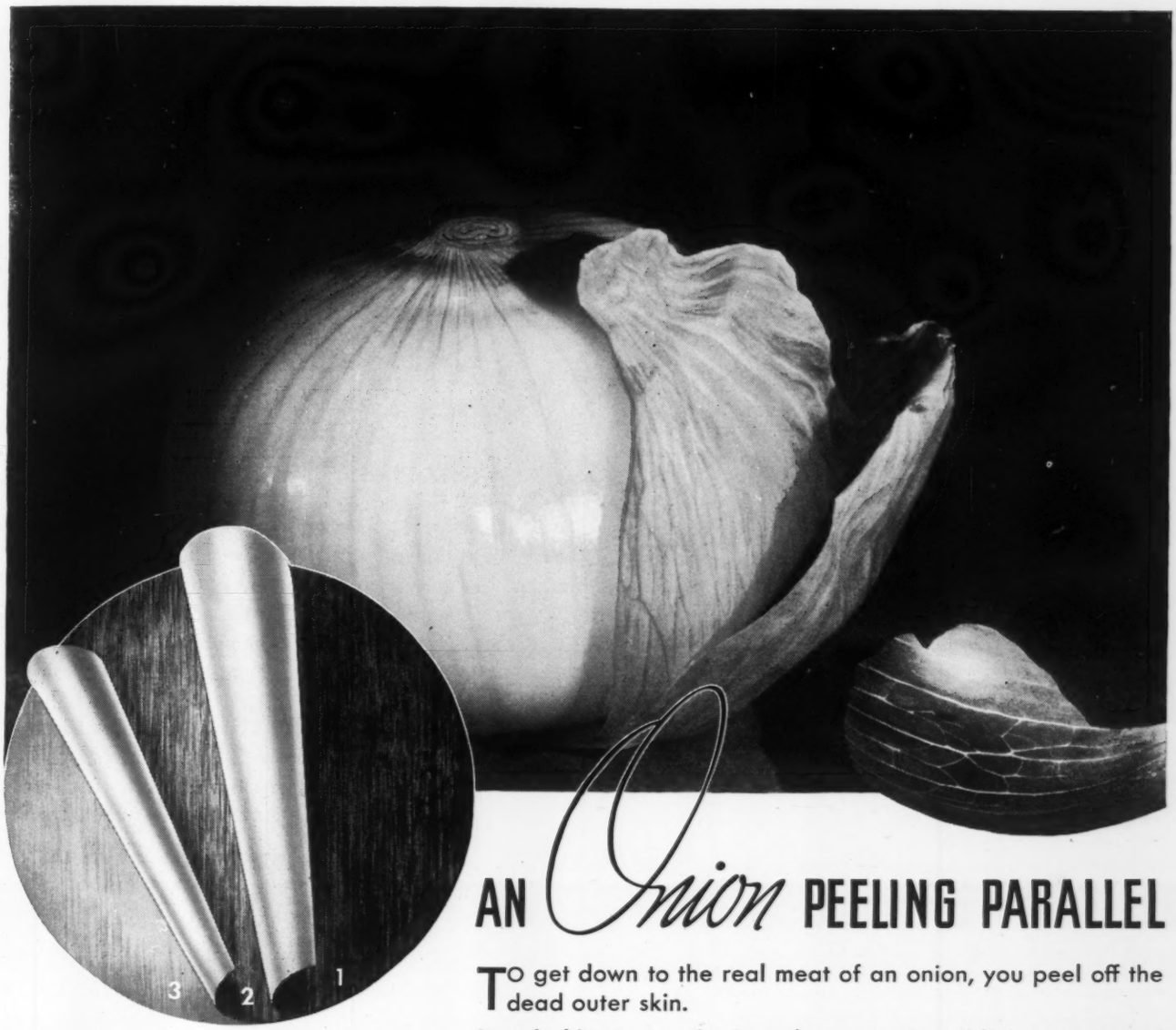
National Warm Air Heating and Air Conditioning association. Meeting and air conditioning exposition to be held at Lakeside Hall, Cleveland. Additional information may be received from Charles F. Roth, International Exposition Co., Grand Central Palace, New York.

Jan. 22-26—

Canning Machinery & Supplies association. Annual meeting and exposition to be held at Stevens hotel, Chicago. S. G. Gorsline, Box 430, Battle Creek, Mich., is secretary.

Jan. 29-Feb. 2—

American Road Builders association. Annual meeting and exhibition to be held in Chicago. Charles M. Upham, 952 National Press building, Washington, is secretary.



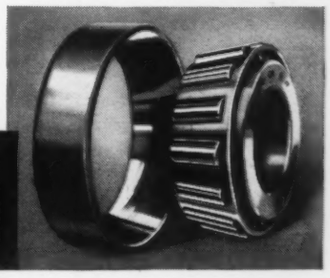
AN *Onion* PEELING PARALLEL

TO get down to the real meat of an onion, you peel off the dead outer skin.

People like to use the homely expression, "slick as a peeled onion" to describe what lies underneath.

There's a striking parallel between a peeled onion and a piece of Micro-Honed steel. Engineers have found after years of experience that there is only one way to get down to the real "meat" of the metal to get a highly finished, mechanically accurate bearing surface: That method is to remove the amorphous, dead metal film left by grinding operations and to further refine the dimensions established by grinding.

Bower Micro-Honing, an exclusive Bower Process, does this and thus lays bare the hard crystaline metal structure free of surface imperfections—thereby producing a finish that meets every last requirement of the perfect bearing surface.



THIS "FACE-LIFTING" OPERATION GIVES YOU BOWER MICRO-HONED BEARINGS

1 **ROUGH GROUND**—Photomicrograph—25 diameters—showing amorphous film with roughness of approximately 15 micro-inches (millionths of an inch).

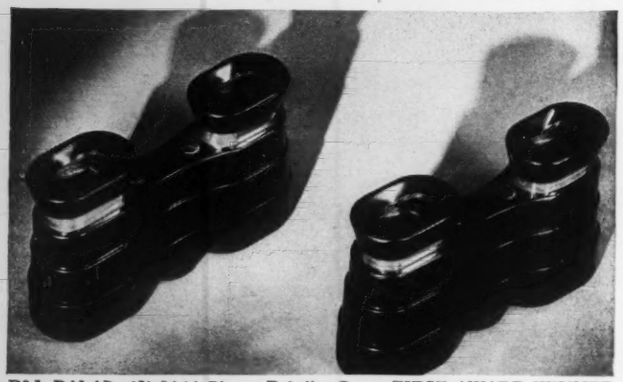
2 **FINISH GROUND**—More but finer scratches—surface finish of approximately 10 micro-inches composed of amorphous metal left by grinding operations—Photomicrograph of 25 diameters.

3 **MICRO-HONED** — 25-diameter photomicrograph showing amorphous metal and grinding marks removed, baring hard surface and smoothness of approximately 3 micro-inches—scratches below surface.

ASK for the Bower folder, "How Bower Roller Bearings Undergo a 'Face-Lifting' Operation by Bower Micro-Honing." It makes clear just what the Bower Micro-Honing process is.

BOWER
ROLLER BEARING CO.
Detroit, Michigan

CHALK UP
Another first FOR AUBURN



B&L BALAK, 3X Field Glass. Bakelite Case. FIRST AWARD WINNER, Scientific Group, "*Modern Plastics*" Competition.

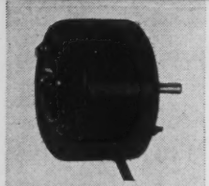
Back in January we showed these B&L Balars under this same headline. Then we were talking of the newness and novelty of these glasses. Bausch & Lomb wanted, we said, a case for them that would express that newness. Naturally they chose plastics and just as naturally, a molder with a reputation for pioneering molding achievements . . . Auburn Button Works.

Today, this headline has an added meaning, for in Modern Plastics' 1939 Competition, top honors in the Scientific group were awarded the B&L Balar. Here's convincing proof that Auburn can handle efficiently, not only the pioneering jobs but can also turn prize-winning drawings into prize-winning molded plastic products.

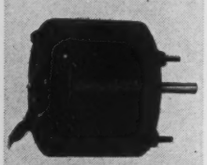
Established 1876

MOLDED PLASTICS DIVISION OF
AUBURN BUTTON WORKS, Inc.
AUBURN, N. Y.—New York, Chicago, Detroit, Cleveland, Rochester, Boston

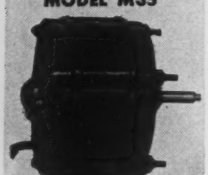
VICTOR
Super-Power
MOTORS



MODEL M41



MODEL M35



MODEL M6

SHADED POLE . . .
. . . Induction Type

Victor offers an outstanding line of quality-built motors of fractional power ranging from 1/200 to 1/10 H. P. Ideal for such applications as fans, blowers, animated displays, timing devices, etc. Years of successful motor building — equipped to solve difficult engineering problems. Write for literature today!

Manufacturers' Representatives:
A few territories not yet assigned. If interested, write us at once.

VICTOR ELECTRIC PRODUCTS, INC.
3041 Robertson Avenue Cincinnati, Ohio

MEN OF MACHINES

(*Concluded from Page* 54)

respectively. Since the war to date, he has been with Jones & Lamson Machine Co. His first position there was to take charge of the recoil mechanisms being built by the company at that time for a special project. Later he became production engineer in charge of production methods, and successively, chief engineer of the Fay automatic lathe division, chief engineer of the company, director, and vice president.

♦

JOHN DOLZA has been appointed special project engineer assigned to advance development problems of the Buick division of General Motors. Replacing Mr. Dolza as assistant chief engineer is EDWARD T. RAGSDALE, for the past several years Buick's body engineer. He will retain all direct supervision over body and sheet metal engineering activities. VERNER P. MATHEWS, an engineer in the chassis division for the past twelve years, has been named chassis engineer in charge of all chassis engineering. Specializing since 1935 in steering suspensions and other phases having to do with ride and handling, JAMES H. BOOTH has become chassis division engineer in charge of that phase of car design and construction. Formerly assistant body engineer, EDWARD F. REYNOLDS has been made body division engineer.

♦

REAR ADMIRAL S. M. ROBINSON, U. S. N., has recently been appointed chief of the Bureau of Engineering. REAR ADMIRAL WILLIAM G. DUBOSE (CC), U. S. N., has been transferred to director of the David W. Taylor Model Basin from chief of the Bureau of Construction and Repair. CAPT. ALEXANDER H. VAN KEUREN (CC), U. S. N., formerly stationed at the Philadelphia Navy Yard as industrial manager, succeeds Rear Admiral DuBose. Captain Van Keuren in turn will be relieved by CAPT. ALLAN J. CHANTRY (CC), U. S. N.

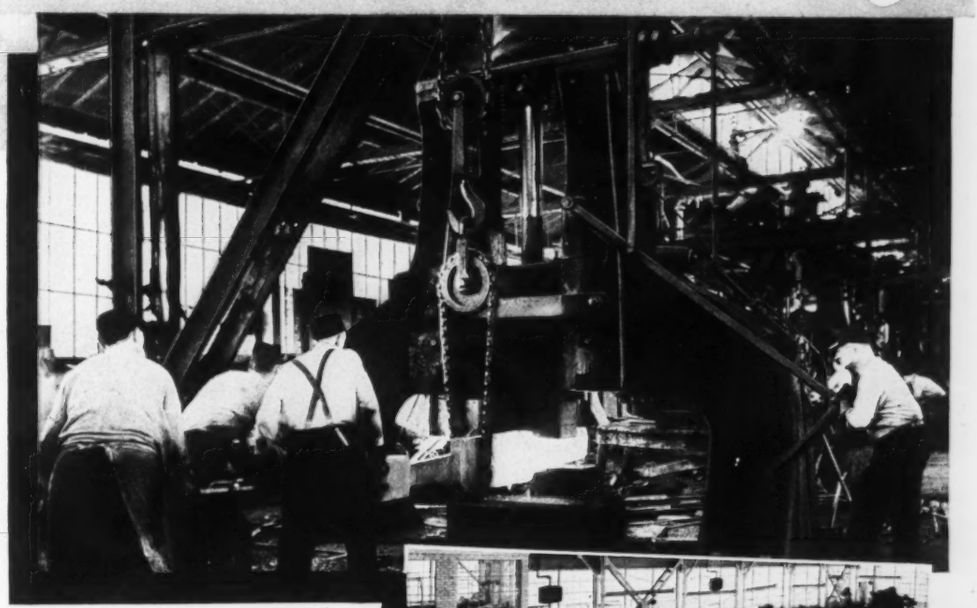
♦

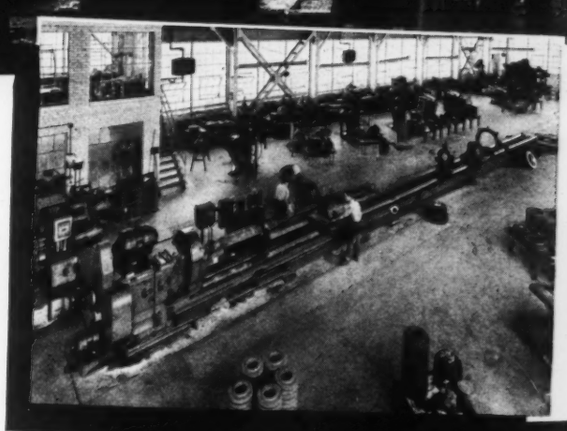
B. H. LAWRENCE has been elected vice president in charge of engineering, United States Steel Corp. of Delaware, and a member of its executive committee and board of directors. Formerly chief engineer, Mr. Lawrence has been connected with the United States Steel subsidiaries during his entire engineering career, serving in engineering capacities in Chicago, Worcester, Mass., and Cleveland, and as chief engineer of the company since January, 1938.

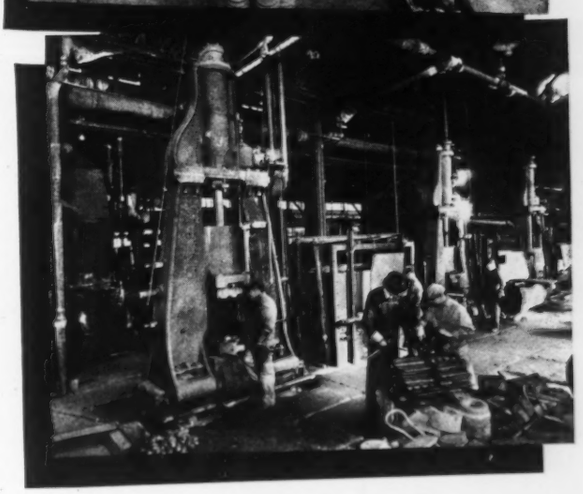
♦

FRED DENIG, vice president of the engineering and construction division, Koppers Co., has been appointed to the newly-created post of director of research for all companies and divisions of the Koppers group.

have some service!







— service such as only Kropp can give to users of forged equipment parts; service based on over a hundred years of forging experience; service that has made Kropp the leading Job Forging Shop of the World; service that provides you with steam hammer, upset, and drop forgings "to your exact specifications" assured by a vast stock of specification steels, a complete set-up of hammer equipment, heat-treating, machining or rough finishing machines — all in one plant.

It is this type of service that has induced many leading equipment builders and manufacturers of tools and fittings to make Kropp their headquarters for forgings. Why not "have some Kropp service" when you next require forgings? Call a Kropp Sales Engineer or send us your blueprints for quotation.

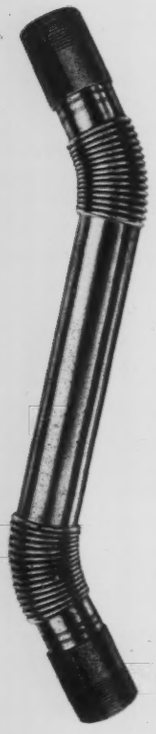
KROPP FORGE COMPANY

World's Largest Job Forging Shop

5307 W. Roosevelt Road, Chicago, Illinois

Representatives in Principal Cities

Top: A large size flat die steam hammer. Center: One of the hollow boring lathes in Kropp's completely equipped machine shop. Bottom: A corner of the Drop Hammer Department.



REX-BELLOWS
STAINLESS STEEL UNITS

Rex-Bellows Units have all the qualities of 18-8 stainless steel—corrosion resistance and durability; higher resistance to fatigue, vibration and continued bending movement. Available in fully corrugated form, and in straight and divided form as illustrated.

Fittings welded by electric resistance circumference seam welding process, forming a completely sealed, leak-proof connection free from soldered, brazed or torch welded joints of any kind. Available in standard pipe sizes from 3/8" to 2" I.D., and assembled to specifications with required fittings.

Applicable to many uses requiring flexible connections for conveying high temperature steam and high temperature gases, air and liquids.

Made in single, double and triple ply to suit the conditions involved. Also, supplied with metal braid covering to withstand higher pressures and to provide additional external protection.

Chicago Metal Hose Corporation
Maywood, Illinois (Chicago Suburb)

WALDRON *Flexible* COUPLINGS

a Type and Size for Every Purpose

GEAR TYPE
Standard Torque Ring
FRANCKE
Standard Marine
SPECIAL Types

Most complete line of forged steel couplings for all drives, all loads. Advanced design and construction improvements insure trouble-free operation. Low initial cost. Write for catalogs giving sizes, service factors, prices. No obligation.

Manufactured by
JOHN WALDRON CORP.
NEW BRUNSWICK, N. J.
SALES REPRESENTATIVES IN PRINCIPAL CITIES

Improving Gear Materials

(*Continued from Page* 49)

high tensile strength. A large number of cast iron gear applications are concerned mainly with wear resistance, in which tooth strength may or may not be a necessary corollary. Nickel-chromium cast irons are generally employed for wear resistant applications, usually with nickel in the range 1 to 2.5 per cent and chromium from .3 to .75 per cent, added to base compositions largely determined by the size of the sections involved and the strength desired. Such irons may provide hardnesses up to 260 Brinell or higher without too great a sacrifice in their machinability.

The nature and distribution of graphite also contribute to better wear resistance. For this reason, the nickel irons of TABLE V contain as high a total carbon content as is consistent with their improved strength properties. A large number of well distributed graphite flakes may serve as oil reservoirs and prevent breakdown of the oil film between the contacting surfaces.

TABLE V

Nickel Cast Irons for Heavy Loads

Size of Gear	Section Thickness	Tensile Strength p.s.i.	Brinell Hardness	Typical Compositions, per cent T.C	Si	Mn	Ni	Cr	Mo
Small	under ¾"	40,000	250	3.3	2.1	.6	1.5	.2	.4
Medium	¾"-1½"	48,000	220	3.2	1.1	.8	1.75	..	..
Large	over 1½"	48,000	240	3.2	1.1	.6	2	.3	..
High Strength	½"-2"	60,000	240	3	1.5	.8	2	..	.65

Nickel, nickel-molybdenum, and nickel-chromium-molybdenum irons are generally employed for high strength applications. The growing popularity of high strength cast iron has placed emphasis upon the need for a high degree of uniformity of properties in order that cast iron may be relied upon as a structural engineering material. At least one manufacturer has developed the practice of labelling each gear with a record of the actual tensile strength and hardness determined on a test specimen representative of the gear itself. This record is accompanied by a listing of certain typical properties. TABLE VI indicates these properties for nickel-chromium-molybdenum cast iron of the following composition: Total carbon,

TABLE VI

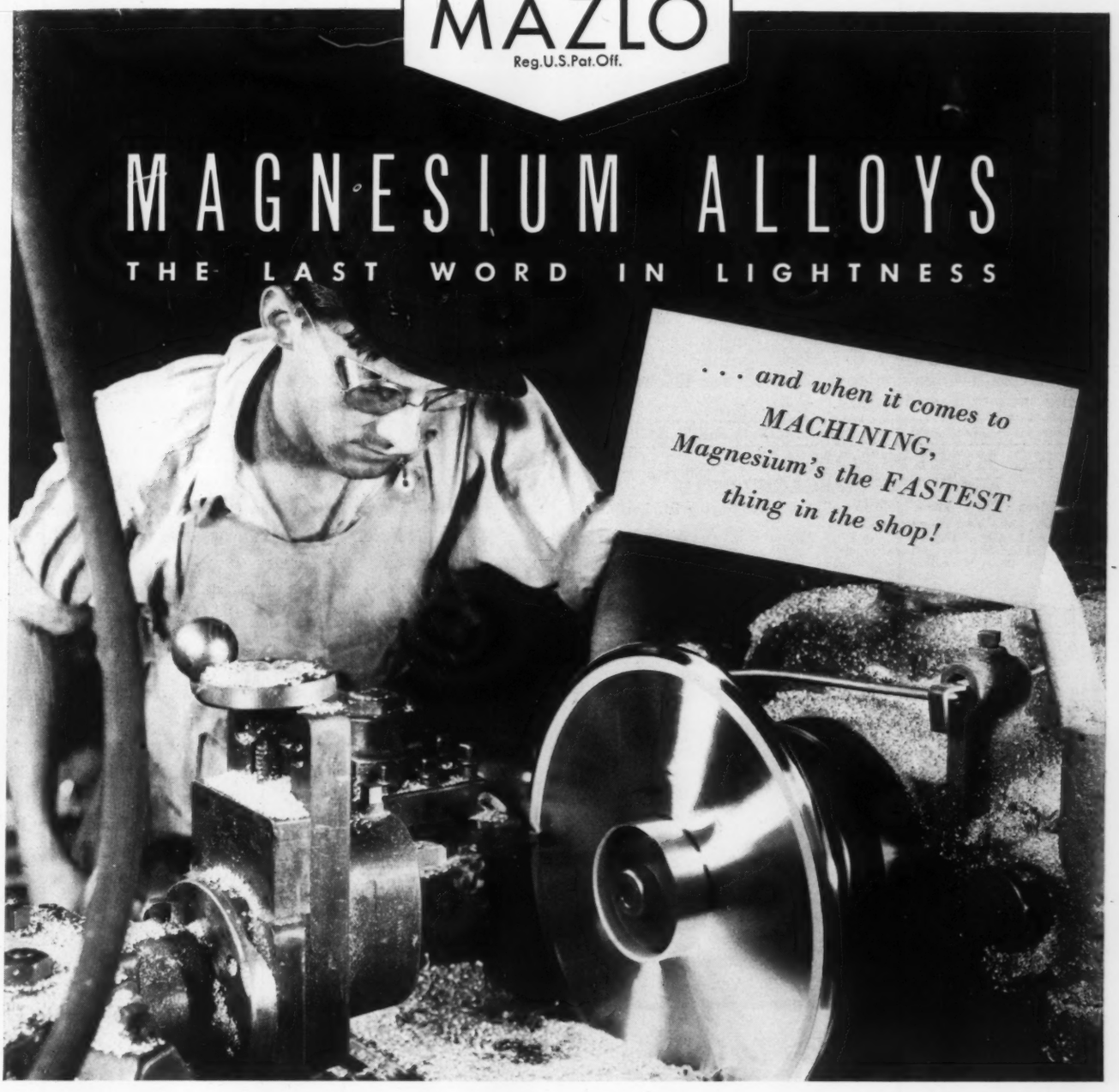
Properties of Nickel-Chromium-Molybdenum Cast Iron

Ultimate Tensile Strength, p.s.i.	50,000
Ultimate Strength in Compression, p.s.i.	150,000
Ultimate Shear Strength, p.s.i.	58,000
Ultimate Torsional Strength, p.s.i.	67,000
Modulus of Elasticity	20,000,000
Torsional Modulus of Elasticity	7,500,000
Transverse Strength-Lbs. (1.2" diam. bar, 18" span)	3,000
Transverse Deflection-Inches (1.2" diam. bar, 18" span)	0.4
Brinell Hardness	220
Weight in Pounds per Cubic Inch	0.26

MAZLO
Reg.U.S.Pat.Off.

MAGNESIUM ALLOYS

THE LAST WORD IN LIGHTNESS



MAZLO Magnesium finishing costs are low, for it machines at high speeds. No tendency to tear, drag, chip out or heat up excessively. MAZLO Magnesium takes a fine, smooth finish. Because of its freedom from porosity and hard spots, you'll find that it greatly reduces your scrap losses.

These savings often completely offset the higher per pound cost for Magnesium. At no additional cost, or only slightly more, you obtain the impressive weight-saving advantages of this lightest of commercial materials.

MAZLO Magnesium Alloys provide a range of physical and fabricating characteristics which enable you to go *very* light economically. MAZLO manufacturing facilities offer you Magnesium in every form: Sand castings, permanent mold and die castings, extruded bar and shapes, sheet, tubing and forgings.

Sales Agent: Aluminum Company of America, 1703 Gulf Bldg., Pittsburgh, Pa.

MAZLO
Reg. U.S. Pat. Off.

AMERICAN MAGNESIUM CORPORATION

PASSES THE "HARD-BOILED" TEST OF DAILY SATISFACTION

Micro-Weave
ALL-AMERICAN
TRACING CLOTH

Micro-Weave
MORE THAN 180 FLAWLESS THREADS PER SQ. INCH

This is a product of over five years of research, skillful development and strict laboratory and field tests—but most of all it is made to meet the "hard-boiled" test of day after day use on exacting, detailed draftsmanship. It is finer, smoother, tougher than ordinary. Send for a generous working sample. Use it—even misuse it—and you'll like the way it does its duty.

Companion Products: Royal Blue Print Cloth and Photo-Cloth

THE HOLLISTON MILLS, INC.
NORWOOD, MASSACHUSETTS
Boston · New York · Philadelphia · Chicago · St. Louis

Fresh, clean and smooth—packed in a handy "Dispenser Box" with brackets for attaching to wall or desk, if desired.

May Be Too Late!

IT'S too late to discover that an important spring in your product has gone bad—*after* the product is on the market. Then complaints start—complaints that can cut deep into your good will—and the products begin their ceaseless trek back to you!

Don't take needless chances. Specify Peck Springs—made by operators who know wire and understand spring design. To get more closely acquainted with "Peck Service," send for the

FREE PECK SPRING BOOK

and also special technical spring data for your engineers and designers. Please write on your letter head.

PECK SPRINGS
AND SCREW MACHINE PARTS
The Peck Spring Co. 10 Wells St., Plainville, Conn.

3.1; silicon, 2.1-2.4; manganese, .8-.9; nickel, .75-1.25; chromium, .15-.3; and molybdenum, .4-.6 per cent.

Upper limits of usefulness of high strength irons is still largely undetermined. While irons of 60,000 pounds per square inch tensile strength are established in industry, irons exceeding this strength may have inherent disadvantages for gears. Low total carbon contents, which are an essential characteristic of such irons, may provide inadequate wear resistance because of an insufficiency of graphite. Higher modulus of elasticity, approaching 25,000,000 pounds per square inch, may also prove disadvantageous, since a low modulus permits better adjustment of surface stresses over a wider area of contact.

Heat Treatment Improves Properties

Use of heat treatment to improve the properties of cast iron gears has been successfully used but not yet to a widespread extent. Some producers practice a simple stress-relief anneal at temperatures up to 1000 degrees Fahr. for the purpose of removing casting strains and promoting toughness. Improvements in strength and hardness are achieved by a quench followed by a draw.

The degree of improvement in properties will depend largely on the nature of the heat treatment. Gears of simple shape, section, and contour can be oil quenched from 1550-1600 degrees Fahr. and drawn in the range 700-1000 degrees Fahr. to produce maximum strength, toughness, and considerable increase in hardness. Where hardness for wear resistance is the dominant requirement, values as high as 580 Brinell can be developed with very low tempering temperatures, but such hard irons are usually weaker and more brittle than the original "as cast" product. Consequently, a hardness range not exceeding 450 to 500 Brinell is generally more practical.

Flame hardening is successfully applied to properly alloyed nickel cast irons. To date, this process has been applied largely to machine tool ways and other flat, bulky castings. Although no practical applications have been reported there is no reason why flame hardening should not be effectively applied to cast iron gears. The general discussion advanced for nickel steels will hold true for the nickel cast irons. The presence of surface stresses which induce a risk of distortion and cracking requires the use of suitably alloyed nickel cast irons of lowered silicon content because of their lower critical ranges, milder and less critical hardening rates, deeper-hardening properties, and tougher underlying cores.

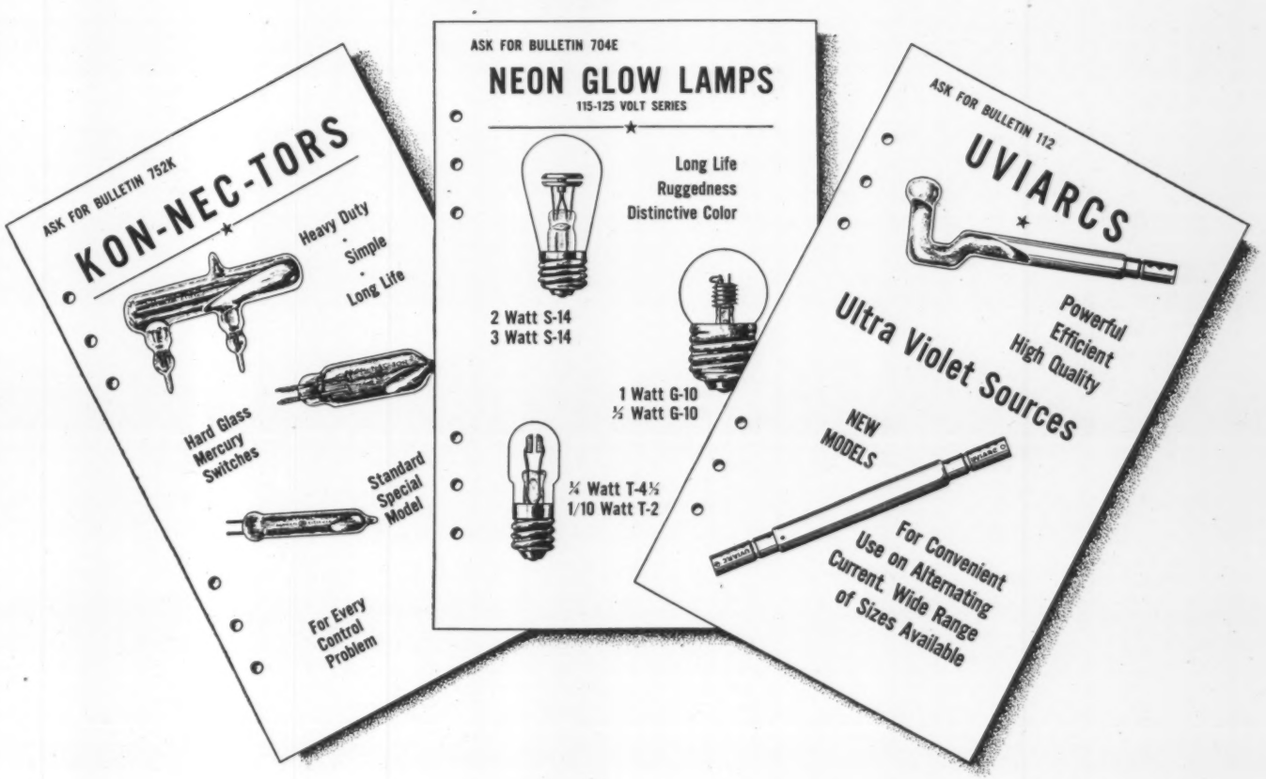
Operating activity for the machine tool industry based on companies reporting to National Machine Tool Builders was 84.9 per cent capacity for October. This is a gain of 10.3 over the preceding month and 32.4 over January, 1939.

Announces

NELA SPECIALTY DIVISION

of the LAMP DEPARTMENT

GENERAL ELECTRIC COMPANY



IN order to better serve you with an important line of specialty items — to give you better sales and design assistance — Nela Specialty Division has been organized, with headquarters at Hoboken, N. J. Here you may obtain the latest information on Mercury Switches, Glow Lamps, Quartz, Mercury Arcs and other specialty items.

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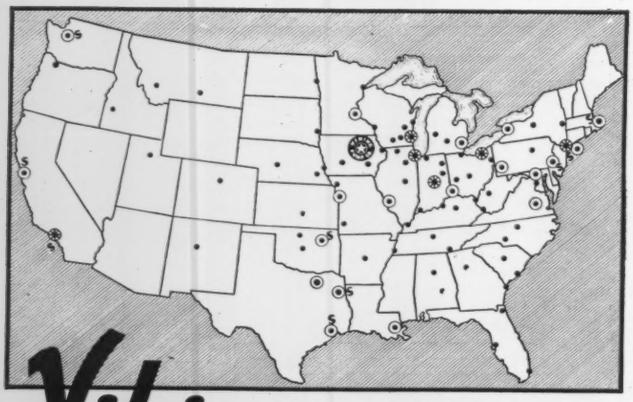

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Viking is ready to serve you. Sales and Service offices, located in every section of the country, are equipped to aid you in the solution of every pumping problem. It has always been the policy of the Viking Pump Company, world's largest rotary pump manufacturer, to build pumps the finest money can buy, to offer service second to none.

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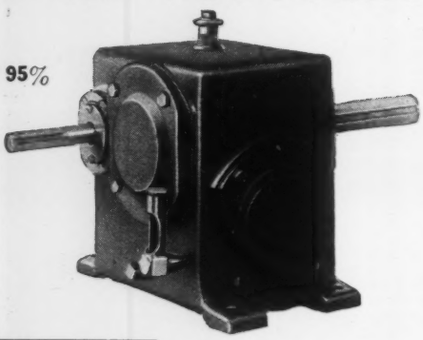
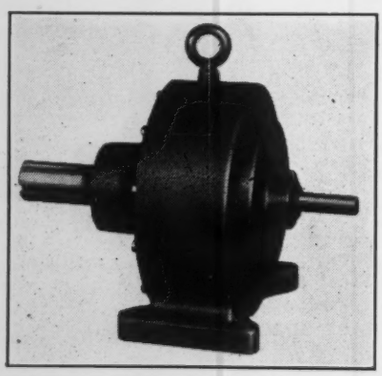
WHS SPEED REDUCERS

OVERALL EFFICIENCY AS HIGH AS 90 TO 95%

Extreme compactness and pleasing, modern appearance . . . just two of many reasons for the popularity of WHS Worm Gear and Differential Speed Reducers.





¼ TO 75 H. P. RATIOS FROM 2-1 TO 20,000-1

A complete line, developed over nearly 40 years, solving all speed reducer problems. *Trained engineering advice at your disposal.* Consult us,—no obligation. Write for catalog.

WINFIELD H. SMITH, Inc.
A Speed Reducer for Every Application
16 ELTON STREET, SPRINGVILLE, ERIE COUNTY, N. Y.

New Patent Laws

(*Concluded from Page* 39)

inventor of the valve in *Fig.* 1 copied these two claims on April 23, 1937, which was more than one year after November 26, 1935, the date of the issue of the patent upon the valve in *Fig.* 4. The new statute will prevent a similar set of facts occurring, as the claims must be copied within one year from the date of issue of the patent in question. An interference proceeding may be instituted in another way. For example, when an inventor who has not as yet filed his application finds in the Official Gazette a drawing and a claim which is the same as his invention he may feel that he is actually the first inventor of the subject matter of the claim. He immediately orders a copy of the patent from the patent office, so that he may study the entire patent. If his study reveals that the two inventions are alike, and if he desires to make a contest of priority of invention, his only course is to file a patent application in the patent office, copying the claims of the patent which already has been issued and requesting that an interference be instituted.

Establishes Interference Examiners

Act 5 took effect on October 5, 1939 and is also designed to reduce the time required to determine finally an interference proceeding which formerly continued in many cases for 3 to 4 years or longer. Under the former practice, the first decision in an interference proceeding was made by an interference examiner acting alone. From this decision an appeal was made to the Board of Appeals in the Patent Office and from there the losing party could appeal either to the Court of Customs and Patent Appeals or to the District Federal Courts, as he so elected. The object of this act was to eliminate at least one of the appeal steps in interference cases. The new law abolishes the appeal to the Board of Appeals while at the same time establishes a Board of Interference Examiners to take the place of the single examiner who formerly rendered the first decision. From the Board of Interference Examiners, the losing party can appeal directly to the Court of Customs and Patent Appeals or to the District Federal Courts. This act shall not affect interferences pending at the time the act took effect, these cases being heard and decided under the old method.

From a study of the above acts, one observes that in general they are directed to the procedural phase of the law to hasten the prosecution rather than to the basic law upon which the patent system has been founded.

Other changes in the patent laws have been proposed and some of these will no doubt come up for study during the next session of Congress.

Actual Size Photo of Type UD Boston Gear Reductor

THE "U" FAMILY TAKES A BOW!

Worm on Top · Type "U" Boston Gear Reductors · From Stock

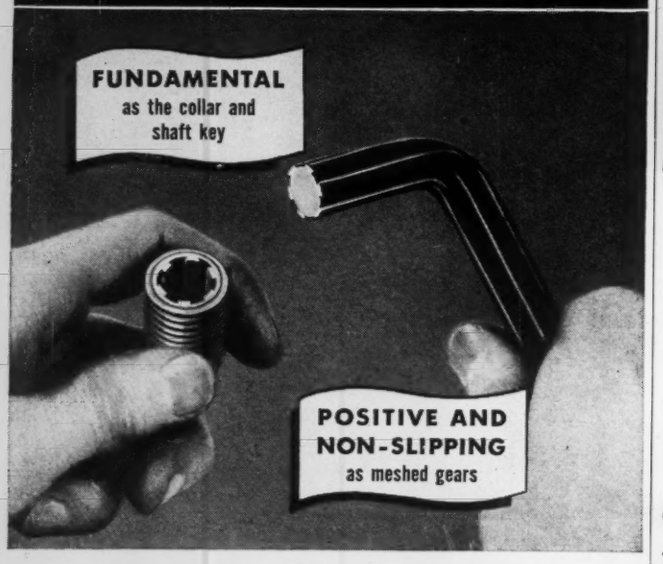
The type "U" speed reducers, as is the case with all Boston Gear products, are designed and built to economically and satisfactorily be of service to you. They are equipped with phosphor bronze worm gears and hardened steel worms which have their threads ground and polished. All shafts are mounted on Timken tapered roller bearings. The type "U" speed reducers are available in five (5) sizes and in speed ratios ranging from 3¾ to 1 up to 100 to 1. Another thing to remember is that they are carried in stock ready for your immediate use. Complete specifications and list prices of these Reductors are contained in the Boston Gear General Catalog. Send for your copy today — just ask for catalog No. 52.

Boston Gear
Complete Line Includes Gears,
Speed Reducers, Chain, Sprockets,
Couplings, Universal Joints, Shaft Supports,
Pulleys, Casters, Ball Bearings and Oilite.

BOSTON GEARS

BOSTON GEAR WORKS, INC., N. QUINCY, MASS.

Multiple Spline is BASIC ENGINEERING DESIGN



Now offered by BRISTO in SOCKET SCREWS for tighter, faster, easier set-up

YOU know the multiple spline design as a time-proved way to transmit power unflinchingly. You've studied it in school. You've seen it used on automobile drive shafts, airplane propeller hubs and in many other important applications.

In incorporating the multiple spline design in socket screws, Bristo has given you a new brand of socket screw performance. A non-splitting, non-rounding out head, a lock-tight wrench engagement, a new ease and speed in tightening, a stamina and strength to withstand the shocks of severest service.

Add to all that, a saving in assembling time which brings production costs down, and you have the big reasons why industry prefers Bristo! Write today for your free copy of Bulletin 83-5N and samples of Bristo Socket Screws. No obligation. The Bristol Company, Mill Supplies Division, Waterbury, Conn.

FEATURES AT A GLANCE!

MULTIPLE SPLINE SOCKET—as positive acting as meshed gears—Won't split, shear, strip, round out, slip or jam—Sets tighter with less effort—No loosening under vibration—Takes wrench without fumbling or skidding.

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Approved by the American Standards Association and the American Society of Tool Engineers

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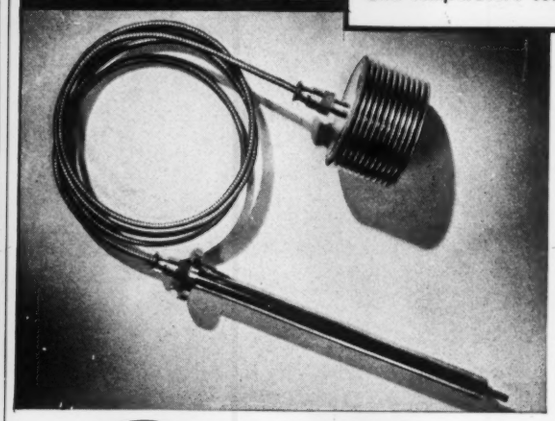
HYDRON

Complete thermal units for self-contained tank regulators and temperature controls. - -



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Metallic Bellows

HYDRON Metallic Bellows are used as control elements in temperature-and-pressure-control devices, and for liquid or gas seals of compressors and pumps. We are specialists in the design and production of complete thermostatic and pressure units for temperature and pressure controls. We are, therefore, prepared to extend the fullest co-operation to engineering departments of control manufacturers in the solution of design and engineering problems.

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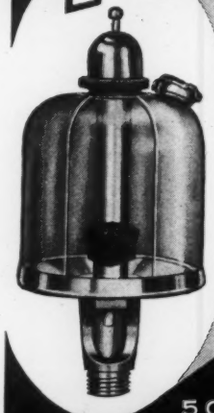
BOSTON CHICAGO DETROIT LOS ANGELES

PRODUCERS OF BELLOWS EXCLUSIVELY
SERVING AUTOMATIC CONTROL MANUFACTURERS

New!!

TRICO

UNBREAKABLE GRAVITY FEED OILERS



ULTRA-MODERN
UNBREAKABLE
STREAM-LINED
NO GASKETS TO LEAK
50% LESS WEIGHT
REINFORCED DUAL RATCHET FEED ADJUSTMENT

AMERICA'S FINEST GRAVITY FEED OILER. MODERNIZED AND STREAMLINED TO HARMONIZE WITH ADVANCED IDEAS OF MACHINE DESIGN. 12 DISTINCTIVE FEATURES—METAL PARTS CADMIUM-PLATED FOR BEAUTY AND EASY-CLEANING. 3 STYLES IN ONE. TWO, FOUR AND EIGHT OZ. CAPACITIES.

WRITE FOR BULLETIN NO. 26

In Canada IRVING SMITH LIMITED, Montreal

TRICO FUSE MFG. CO. Milwaukee, Wis.

253 STANDARD LIMIT SWITCHES

for Limiting Machine Travel or Controlling Work Cycles

Limit switches are necessary for maximum safety, output, and convenience on motor-driven machines. There is a standard Allen-Bradley unit for practically any limit switch requirement. Send for limit switch catalog for ready reference.

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

LIMIT SWITCHES- for Every Service

TO insure correct operation, eliminate production delays, and prevent damage to the machine, the tool, or the work, it is important to select the proper limit switch. Allen-Bradley offers you limit switches with every type of lever arm, every type of enclosure, any combination of normally open and normally closed contacts, arranged for 1, 2, or 4 circuits. There are three standard ratings.

Knowing your limit switch requirements, as enumerated in this check list, it is easy for you to select the Allen-Bradley limit switch for your exact needs.

What to Consider in Selecting Limit Switches

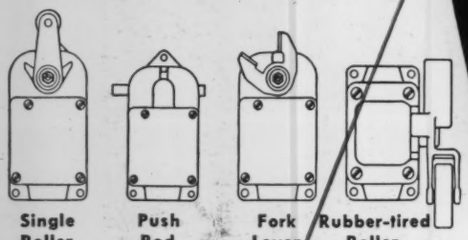
A Type of Mechanical Motion
1. Straight-line, curved, or rotary.
2. Length of travel and overtravel.
3. Speed and force of movement.

B Type of Control Circuit
1. Number of circuits.
2. Interrelation of circuits (normally open or normally closed).
3. Maintained or spring-return contacts.
4. Snapover or slow-acting mechanism.

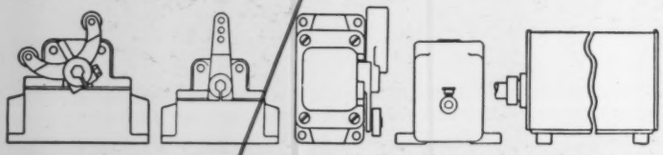
C Current Rating

D Type of Enclosure
1. With or without enclosure.
2. Enclosure classification.

LEVER ARMS

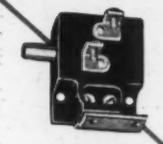


Single Roller | Push Rod | Fork Lever | Rubber-tired Roller



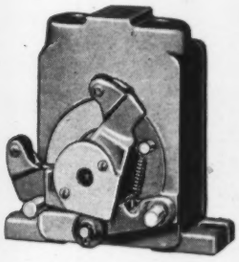
Roller Fork Lever | Rod or Chain Operated | Weight Operated | Geared | Rotating Cam

CAPACITIES



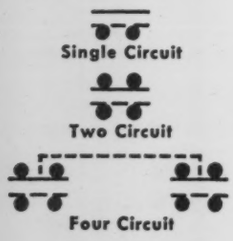
Light Duty
A.C. — 3 amp.
D.C.—1 amp., 115 v.;
0.5 amp., 230 v.;
0.25 amp., 550 v.

Standard Duty
A.C. — 5 amp.
D.C.—2 amp., 115 v.;
1 ampere, 230 v.;
0.3 amp., 550 v.



Heavy Duty
A.C. — 10 amp.
D.C.—4 amp., 115 v.;
2 amperes, 230 v.;
0.5 amp., 550 v.

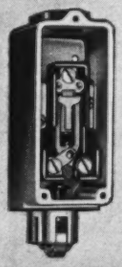
CIRCUITS



Single Circuit
Two Circuit
Four Circuit

Available in any combination of normally open and normally closed contacts.

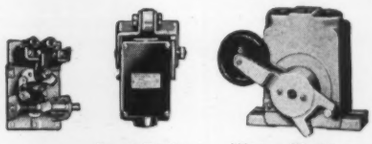
For PRECISE Machine Control



Your machine operations can be held within extremely close limits by using this new snap-acting precision switch. Its operation requires only a 0.005-inch throw, which is consistently maintained regardless of mounting position and is not affected by vibration. This compact switch has long-life silver contacts and is good for millions of trouble-free operations.

Bulletin 801 Precision Switches

ENCLOSURES



Open | Dust-Tight Splash-Proof | Water-Tight or Explosion-Proof

Write for Bulletin 801

ALLEN-BRADLEY COMPANY
1333 South First Street
Milwaukee, Wisconsin

ALLEN-BRADLEY

Manufacturers of

SOLENOID MOTOR CONTROL

QUALITY

There are two kinds of news—the news of today and the news of tomorrow. Veeder-Root Counting Devices write both.

Throughout industry, the news of the day—the production bulletins—are reported promptly and accurately by Veeder-Root Counters mounted on presses, cutters, looms and hundreds of other machines—counters that record operations or pieces produced.

While on the other hand, Veeder-Root engineers, working with manufacturers, are constantly finding important applications for counting and computing devices. These applications make the news of tomorrow—good news to salesmen, because a built-in Veeder-Root Counting Device often increases the utility and sales of a product.

Keep up with the news of Veeder-Root Counting Devices. Send for our booklet that gives a complete picture of their interesting possibilities.

VEEDER-ROOT Inc.

HARTFORD, CONNECTICUT, U. S. A.

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The machine tool market asks for more pieces per hour. The machine tool asks for higher speed and more automatic control. The machine designer asks for ideas.
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Lathe & Grinder Inc.
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Automatic Oil Lubrication
BLANCHARD PULSOLATOR

SpeedWay
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FLEA POWER MOTORS
110 VOLT
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Low Cost made possible by improved designs, large quantity production and production methods . . . Dependability developed thru hundreds of different applications in the field . . . Stamina built-in for continuous operation and . . . . . High torque developed thru integral back gearing . . . . Cased or skeleton types with standard gears that give "any" speed, that save engineering, cost, and space of requirements of auxiliary speed reducing means . . . . Single drives, double drives—from top, bottom, right or left. Miniature motors for a hundred uses; motors that make automatic tuning, automatic opening and closing, automatic features that make sales at incidental costs.
Sold singly, in dozens, thousands or millions.
SPEEDWAY MFG. CO.
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WRITE for SPECIFICATIONS and PRICES

MANUFACTURERS' *publications*

ALLOYS (IRON)—Duraloy alloys composed essentially of iron with chromium and nickel are discussed in bulletin 3926G, published by The Duraloy Co., Scottdale, Pa. For resisting corrosion, high temperatures and abrasion, these alloys may include molybdenum, titanium, columbium, selenium, sulphur, tungsten, manganese or silicon. A handy table lists characteristics of various Duraloys.

BEARINGS (BALL)—Another bulletin, IV-7, has been added to the ring binder on industrial bearing applications issued by New Departure division, General Motors Corp., Bristol, Conn. This booklet discusses an example of an application of precision ball bearings to a horizontal boring and milling machine headstock.

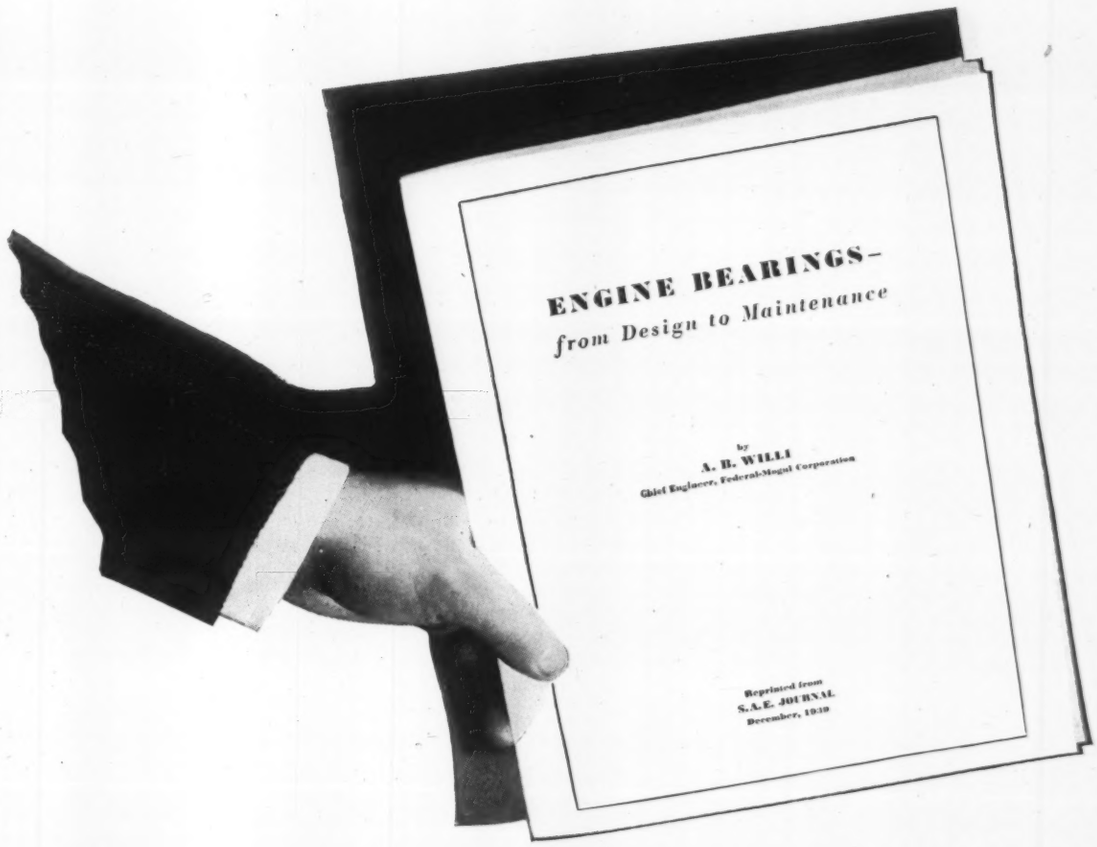
BEARINGS (BRONZE)—To facilitate specification of the correct part number for bearings, Johnson Bronze Co., New Castle, Pa., has prepared a slide rule which can be manipulated, after inside or shaft diameters are noted, to indicate part numbers when the proper outside diameters and lengths are found. Requests on business letterheads will be honored.

BELTING (LEATHER)—A calculator in the form of a slide rule for determining the various factors in connection with leather belting has been prepared by J. E. Rhoads & Sons, 35 North Sixth street, Philadelphia. It takes into consideration the diameter of the driver pulley, belt speed, horsepower per inch, and required horsepower.

CABLE—Thinwol, an insulating compound with 85 per cent new-rubber content, for thin-wall applications on multiconductor control cable, is described in leaflet GEA-2423A, issued by General Electric Co., Schenectady. Advantages claimed include small overall diameter for the cable insulated with Thinwol, high dielectric strength, low dielectric constant, high insulation resistance and low moisture absorption.

CLUTCHES—Overload release disk clutches, series 650, are described and illustrated in bulletin S-10 issued by Conway Clutch Co., 1543 Queen City avenue, Cincinnati. Other pages of the bulletin discuss slip clutches with or without extended sleeve, and disk clutch couplings. Dimensions and cross-sectional views are included.

CLUTCHES (MERCURY)—Discussing its new clutch which operates through centrifugal displacement of mercury, Mercury Clutch Corp., Massillon, O., has issued a bulletin in color. Parts of the clutch are shown graphically in cutaway views and perform-



THIS GUIDE TO IMPROVED BEARING SELECTION SENT YOU FREE!

REPRINT OF A PAPER DELIVERED BEFORE WORLD ENGINEERING CONGRESS

For the designer or purchaser of bearings, this paper can become a useful guide in specifying or buying bearings for many types of machines and appliances.

Among the interesting facts it reveals is that bearings made of babbitts of practically identical specifications, may have widely different performance results, *depending upon the method of manufacture.* It illustrates that the engineer or manufacturer of machines and appliances should *know* the manufacturing process used to produce his bearing requirements, in order to obtain the greatest value in bearing efficiency at the price paid.

A copy of this interesting article will be sent free to those requesting it on their company letterhead, or using the coupon below. A limited supply is available, therefore we urge you to write at once.

FEDERAL-MOGUL CORPORATION, 812 SHOEMAKER AVENUE, DETROIT, MICHIGAN

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Please send me a free copy of the new article: "Design of Engine Bearings"

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BARCO

REVOLVING JOINTS

For water cooling or heating of

TUBERS, MILLS AND CALLENDERS

A truly universal joint for heating and cooling all types of rotating rolls. Eliminates packing troubles due to strains in ordinary stuffing boxes.

Barco Manufacturing Co.
1820 Winnemac Avenue, CHICAGO, ILL.
In Canada: The Holden Co., Ltd.

IT TAKES MORE THAN BRAWN— TO CRACK DIFFICULT PROBLEMS IN SPRINGMAKING

Raymond has over fifty years of reliable experience to put to work on your spring needs

RAYMOND SPRINGS
WIRE FORMS
STAMPINGS

RAYMOND MFG. CO., DIV. OF ASSOCIATED SPRING CORPORATION
280 SO. CENTRE ST. · CORRY, PENNSYLVANIA

ance charts are included to illustrate the clutch's efficiency.

CONTROLLERS—Heavy-duty skip hoist controllers for squirrel cage motors are described in a new booklet, 11-840, issued by Westinghouse Electric & Mfg. Co., East Pittsburgh. The units consist of contactors and relays mounted on an ebony-asbestos base, supported by angle-iron framework or enclosed in a sheet steel cabinet.

DRAWING INSTRUMENTS—Keuffel & Esser Co., Hoboken, N. J., has issued an illustrated folder in color describing its Minusa drawing instruments. The No. 796 set comes in a pocket case and includes compasses, dividers, pencils and pens.

DRIVES—Bulletin GEA-3285 published by General Electric Co., Schenectady, describes a new reversing planer drive, variable voltage type. This drive includes: Direct-current planer motor; three-unit motor generator set of suitable size; manual reduced-voltage starter for the motor of the motor-generator set; variable-voltage reversing planer controller; planer rheostat panel; planer limit switch; planer pendant pushbutton station.

FINISHES—A four-page catalog section on its line of Acidseal paints, derived from rubber, has just been published by the B. F. Goodrich Co., Akron, O. The catalog section lists all properties of the paint, directions for use, each type, with its special properties, and includes an exact reproduction of the different colors in which the paints are available.

FINISHES—Number four of *New Wrinkles in Finishes,* issued by New Wrinkle Inc., Mutual Home building, Dayton, O., lays special emphasis on decorative effects in color which can be achieved with New Wrinkle. Other articles show applications of this finish.

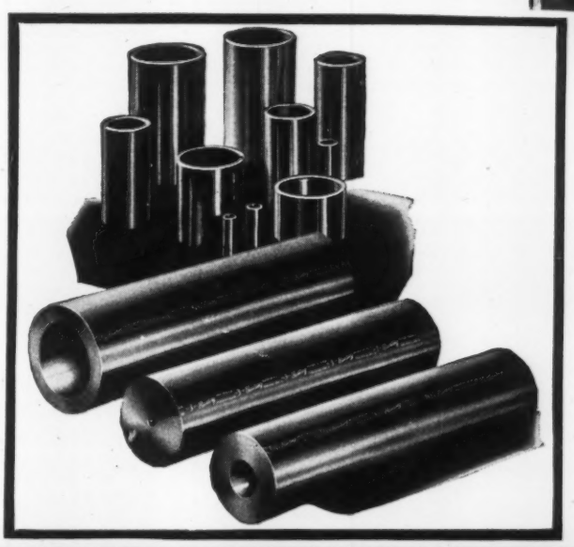
MOLYBDENUM—A beautifully illustrated and made up brochure, "Molybdenum in the Foundry," has been published by Climax Molybdenum Co., New York, discussing the advantages and effects of molybdenum in cast iron and cast steel. A feature is a two-page table listing typical applications for molybdenum irons, along with analyses and remarks.

MOTORS—A four-page mailing folder, X-3558, has been issued by Emerson Electric Mfg. Co., St. Louis, picturing and briefly describing its complete line of stock motors, 5-horsepower and smaller. Besides complete performance and price data, a general description of repulsion-induction, capacitor, split-phase, polyphase and direct current motors and their uses, facilitates correct motor selection.

MOTORS—End mounting motors in both complete and skeleton types for air filters, blowers, and similar applications are described in leaflet F-8493 issued by Westinghouse Electric & Mfg. Co., East Pittsburgh. An externally mounted thrust bearing is especially designed to permit adjustment, allowing end-play to be taken up after the machine is assembled.

MOTORS—Type K totally enclosed, fan-cooled mo-

THE BRONZE BAR WITH THE *Bored* I.D.



● Precision boring is responsible for the smooth finish and concentricity of Bunting Bearing Bronze Tubular Bars. Only a 1/64" cut is necessary to finish to desired bearing size. Ask the leading wholesaler in your vicinity.

● Nine times out of ten you can get the size of *finished* bearing you want from the complete stocks of Bunting Standardized Bronze Bearings carried by leading wholesalers everywhere. They are ready for assembly meeting practically all mechanical production and maintenance requirements. Write for catalog.

Send in your blueprints for quotations on special designs and alloys. Ask for free counsel on bearing metallurgy and engineering.

THE BUNTING BRASS & BRONZE CO.
TOLEDO OHIO
Warehouses in All Principal Cities

BUNTING

BRONZE BUSHINGS
PRECISION BRONZE BARS

BEARINGS
BABBITT METALS

SPIRAL GEARING

— in the finer pitches 14 to 96 D. P.

Also **SPURS—BEVELS—WORM GEARING**

Your small Gear needs may be few or many — experimental or production — 'fussy' or 'commercial' — intricate or simple — Whatever they are, consult SPECIALISTS such as —

Made to order only *No stock* *No catalog*

Gear Specialties
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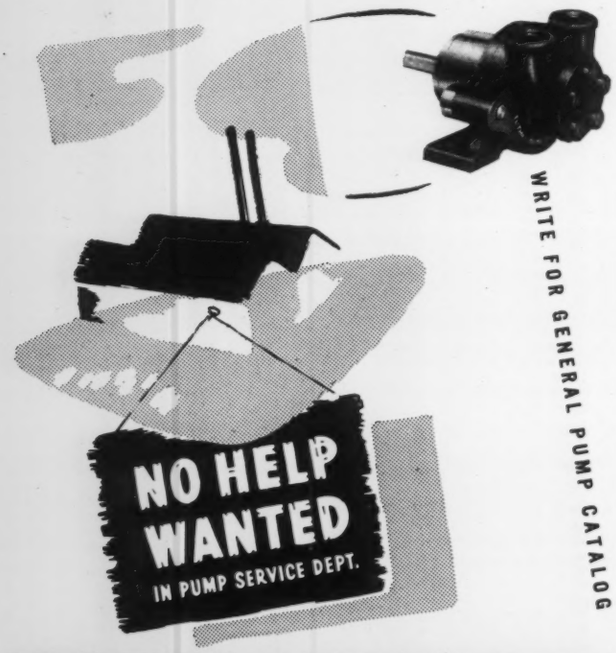
CHICAGO

2670 W. MEDILL AVE. Phone, Humboldt 3482



WE USE *Dependable* TUTHILL PUMPS

TUTHILL PUMP COMPANY • 941 EAST 95TH STREET • CHICAGO, ILL.

tors, ranging from ½ to 100-horsepower, polyphase and single phase, are described in an illustrated booklet in color, K-20, issued by Howell Electric Motors Co., Howell, Mich. Features include more and better insulation, improved coil varnish, fan-cooling, and rotor construction of rolled copper end ring and copper bar, welded and brazed together.

MOTORS, GENERATORS—General Electric Co. has issued new bulletins GEA-137D and GEA-1960A coverign low-speed synchronous motors and low-speed synchronous generators, respectively. Stators and rotors of both units are disassembled diagramatically and features of parts are pointed out.

SPEED REDUCERS—Worm-helical speed reducers are covered in a new 16-page bulletin issued by the W. A. Jones Foundry & Machine Co., 4401 Roosevelt road, Chicago. This type of speed reducer was developed for vertical shaft drives where a large reduction in speed is required.

SPRING WASHERS—Subject of bulletin No. 3 published by the Spring Washer Industry, 550 Wrigley building, Chicago, is "The Relation of Maintained Adequate Pressure on Threads to the Tightness of Bolted Parts." It is pointed out how helical spring washers maintain pressure over a long period. Pertinent photographs and drawings are included.

STEEL—A compact chart giving tensile strength, yield point, elongation, reduction of area, hardness and other average physical properties of nearly 50 different types of steel has been published by Joseph T. Ryerson & Co., Chicago. Compactly arranged, the 8½ x 15-inch chart is especially convenient for use as a reference.

STEEL—Quality of steel made by the new photoelectric control of the bessemer process is emphasized by Jones & Laughlin Steel Corp., Pittsburgh, in a new illustrated bulletin. The "electric eye" notes changes in the bessemer flame which are recorded on a chart, making it possible to eliminate fluctuations in quality of bessemer steel. Parts made from this stock are shown, including oil pump bushings, belt pulleys, motor pinions and guard bearings.

STEEL (MANGANESE)—The how and why of manganese steel is explained thoroughly in catalog No. 59, just published by American Manganese Steel division, American Brake Shoe & Foundry Co., Chicago Heights, Ill. Many examples are shown of applications of this metal, and the company's history and facilities are described. A complete index facilitates reference.

STEEL (STAINLESS)—To assist selection of grades of stainless steel which meet maximum physical requirements at the lowest possible cost, Carpenter Steel Co., Reading, Pa., has issued a new booklet, "Design." Variable qualities are discussed, such as strength, color, permanence, weight, stiffness, welding, and machining. Pertinent illustrations drive home points.

KLAGES GRINDERS

EQUIPPED WITH BANTAM QUILL BEARINGS

Improve AUTOMOBILE GLASS PRODUCTION METHODS

● Grinding of the pencil (rounded) edges on plate and automobile glass has been, for years, a difficult time consuming job. Then G. W. Klages & Son, Inc., Pittsburgh, Pa., perfected an almost human grinding machine which amazingly increased speed and efficiency. Soon these fast-acting grinders were adopted by practically all the large plate and automobile glass producers in the United States, Canada, France and England.

When Klages re-designed this famous grinder to materially increase production they standardized on BANTAM QUILL BEARINGS on both of the grinding arms. This eliminated the sidewise motion of the arms which hold the glass against the grinding wheel. Just one more instance of the reliance industry has come to place on BANTAM for bearings at critical spots where accuracy and dependability are vital.

BANTAM QUILL BEARINGS have solved scores of difficult bearing problems in widely varying fields. Write us for engineering data and complete information.

BANTAM BEARINGS CORPORATION
South Bend, Indiana

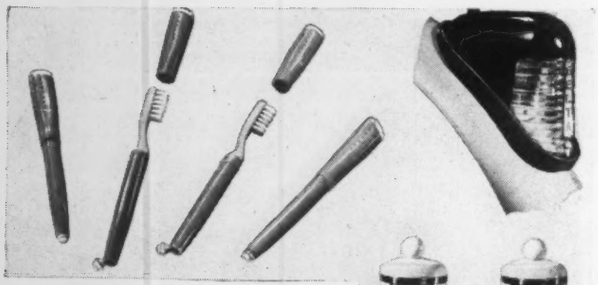
Subsidiary of THE TORRINGTON CO. Torrington, Conn.

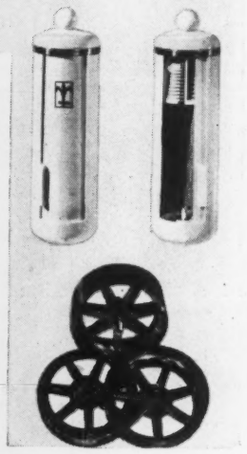
Four Bantam Needle Bearings are used in the two grinding arms of the new improved Klages grinder to prevent sidewise motion.

BANTAM BEARINGS

TAPERED ROLLER •• STRAIGHT ROLLER •• BALL

4 AWARD WINNERS





OF THE 1939 MODERN PLASTICS COMPETITION . . .

Top Award in the Novelty Group Denta-Kit Tooth Brush molded of Tenite for Violette, Inc., Chicago, Illinois.

Top Award in the Transportation Group, the Bicycle Guardlite molded of Tenite for Delta Electric Company, Marion, Indiana.

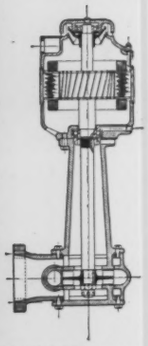
Honorable Mention in the Household Group, Saniway Tooth Brush Sterilizer molded of Plaskon for Practical Products, Inc., Indianapolis, Indiana.

Honorable Mention in the Industrial Group, Cardineer Rotary File Wheel molded of Durez for Diebold Safe and Lock Company, Canton, Ohio.

These awards speak for themselves as evidence of our consistent ability as Custom Molders of all types of plastic materials.

CHICAGO MOLDED PRODUCTS CORPORATION
1028 North Kolmar Ave. Chicago, Illinois

Model No. 11020A



Model No. 11022 Patented and Patents Pending

FOLLOW THE TREND

CHANGE TO

THE GUSHER COOLANT PUMP

Machine designers are using more and more Gushers. The reason? Gushers are the pumps of tomorrow—simple in construction and easy to apply.

Gusher ball-bearing pumps are quiet, have split-second control and are designed to handle materials that contain grit and abrasives.

Pipeless Gushers will beautify your machines as well as end all your coolant problems.

SIMPLIFY YOUR MACHINES
USE "GUSHERS"

Write for Engineering Specifications

THE RUTHMAN MACHINERY CO.
540 E. FRONT ST. CINCINNATI, OHIO

Business and Sales Briefs

APPOINTMENTS of two new factory representatives have been announced by Allen-Bradley Co., Milwaukee—in Oklahoma and Arkansas, Paul Berry, 39129 N. W. Twenty-sixth street, Oklahoma City, Okla.; and in Nebraska and Western Iowa, A. V. Sorensen, Midwest Equipment Co., 1206 Farnam street, Omaha.

♦

Formerly of the Chicago staff of Allis-Chalmers Mfg. Co., W. F. Daly has been appointed district office manager of the company in St. Louis. C. L. Orth, manager of this office for the past twenty-nine years, will continue in a consulting and sales capacity.

♦

Widely known in the automotive and metal working industries through his activities in technical organizations, W. M. Hayes, Detroit district manager of Air Reduction Sales Co., for the past 13 years, has joined the sales organization of P. R. Mallory & Co. Inc.

♦

Recent appointments have been made by Sherwin-Williams Co., Cleveland. These are G. H. Robertson as head of the industrial sales department, E. L. Hehl, eastern manager of this department, H. S. Sherman, central district manager, and Lyman Weber, southwestern district manager.

♦

C. W. Hedler and R. L. Miller have been appointed assistant sales managers of Norma-Hoffmann Bearings Corp., Stamford, Conn.

♦

For several years associated with the welding section of the industrial department of General Electric Co., Schenectady, N. Y., Willard A. Terry has been placed in charge of electric welding sales on the Atlantic seaboard. C. I. MacGuffie, arc welding specialist in the Atlantic district, will assume Mr. Terry's duties in Schenectady.

♦

Licensing of St. Louis Surfacer & Paint Co., St. Louis, and Allied Finishing Specialties Co., Chicago, to handle its line of wrinkle finishes has been announced by New Wrinkle Inc., Dayton, O.

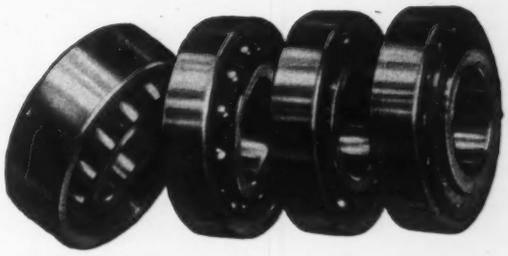
♦

Formerly connected with Behr-Manning Co., H. S. Meech has been made sales manager of Buckeye Brass & Mfg. Co., Cleveland.

♦

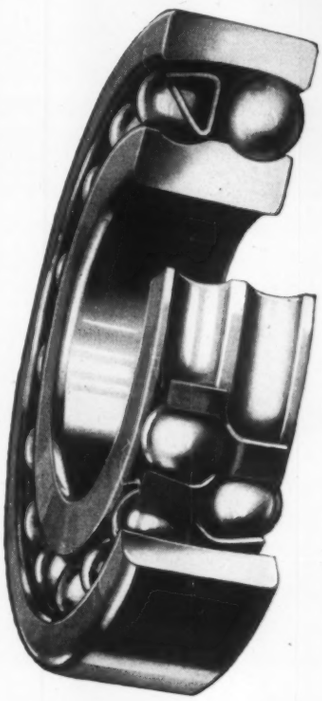
Identified with Continental Steel Corp., Kokomo, Ind., since 1928, John F. McComb, formerly assistant sales manager of the wire division, has been named sales manager of the sheet division for Kokomo and Indian-

SHREDDERS OF



ALL KINDS ARE ALWAYS MODERNIZED WITH SKF PILLOW BLOCKS

● *300 h.p. swing hammer shredder rebuilt by The Consolidated Products Co., Inc., for service in a British East Africa sugar refinery.*



SKF PILLOW BLOCKS ARE COMPACT, ASSURING DEPENDABLE BEARING PERFORMANCE THE WORLD OVER

● Somewhere in British East Africa, this SKF Bearing is saving power, maintenance and labor costs on a rebuilt 300 h.p. swing hammer shredder in a sugar refinery.

It replaces a babbitt bearing on a 6.2992″ diameter shaft at 1000 r.p.m., and takes the brunt of loads imposed by 42″ tip diameter hammers battering the material.

With SKF Pillow Blocks, it's just as easy to modernize a refinery 12,000 miles away as it is to bring your equipment up-to-date right here at home. You are assured of SKF service through SKF factory-owned offices in every civilized quarter of the globe.

Ask your SKF distributor to survey your bearing proposals for shafts from ⅝″ to 30″ in diameter. He'll be glad to give you further information regarding types, sizes, prices, etc., of these compact, carefully machined, low-cost pillow blocks.

4405

SKF
Ball and Roller Bearings

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.

apolis plants of the company. A. C. Huber, who has been assistant sales manager of the manufacturers' sheet division since 1931, has been appointed sales manager of that division, also for both plants. For the past nine years assistant sales manager of the sheet division, Hoyt Shepard has been named assistant to the general sales manager.

♦

At the recent annual meeting of Meehanite Research Institute of America, present officers of the organization were re-elected. Officers include: O. Smalley, president; H. B. Hanley, vice president; F. M. Robbins, secretary-treasurer.

♦

For many years sales engineer in the Middle West, Terry Fisher has been placed in charge of sales of Cutler-Hammer's line of motors and controls in northern Indiana territory, with headquarters in South Bend, Ind.

♦

Ohio Gear Co., Cleveland, has appointed Standard Machinists Supply Co., South Second and McKean streets, Pittsburgh, as representative for the company's line of gears, speed reducers and power transmission equipment in the Pittsburgh area.

♦

Martindell Molding Co., Trenton, N. J., newly organized, has built and equipped a modern plastics molding factory at North Olden avenue and Sixth street, Trenton, N. J. The officers of the company are: M. H. Martindell, formerly vice president and general manager of Jos. Stokes Rubber Co., president and secretary-treasurer; Godfrey Zentmayer, vice president; and H. P. Koenneke, engineer and general manager.

♦

Two new engineering-sales agents have been appointed by Mechanical Handling Systems Inc., Detroit, manufacturers of conveyors and allied materials handling equipment. These are Wonham Inc., 44 Whitehall street, New York, to cover Connecticut, Northern New Jersey and the southern portion of New York state; and Kearney Engineering Co., 2402 Market street, Philadelphia, assigned to Southern New Jersey, Wilmington, Delaware and Eastern Pennsylvania vicinities.

♦

Marblette Corp., 27 Thirtieth street, Long Island City, will acquire another building in order to expand its factory floor space.

♦

Announcement of the following appointments to handle its line has recently been made by Hewitt Rubber Corp., Buffalo: Wimberly & Thomas Hardware Co., Birmingham, Ala.; Machinery & Supplies Co., Kansas City, Mo.; Bitco Inc., Wallace, Idaho; McChesney-Rand Equipment Co., Albuquerque, N. M.; P. J. Hanns Co., Eugene, Ore.; Texas Belting & Supply Co., Houston, Tex.; and C. D. Franke & Co. Inc., Charleston, S. C.

Here's a safety insurance policy for the machines you design — Equip with

UNBRAKO

SELF-LOCKING HOLLOW SET SCREWS with the Knurled Points

Fig. 1645 Pats. Pend.

Breakdowns, caused by ordinary set screws shaking loose, can be prevented very simply by using "Unbrako" Self-Lockers. And by so doing you reduce the maintenance headache too. Here's why:

The knurling around the points of "Unbrako" Self-Locking Hollow Set Screws holds them fast when tightened up in the normal way—and no amount of vibration can rattle them loose. Even so, removal for adjustment is easy and the screws can be re-used over and over again.

Fig. 1646 Pats. Pend.

"UNBRAKO" SQUARE HEAD SELF-LOCKING SET SCREWS offer this same unfailing protection combined with high strength and accuracy. We'd be glad to send you a sample so you can see for yourself.

STANDARD PRESSED STEEL CO.

BRANCHES BOSTON DETROIT INDIANAPOLIS

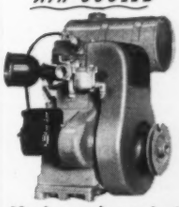
JENKINTOWN, PENNA.

BOX 102

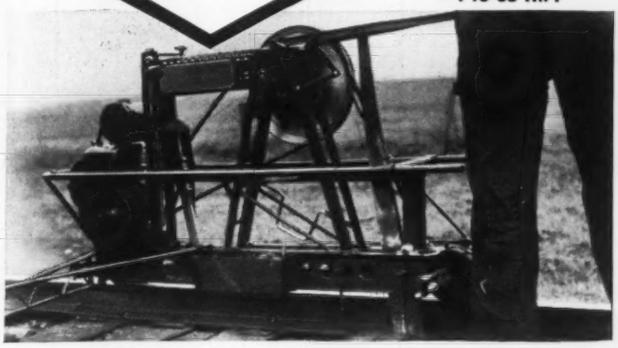
BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

WISCONSIN AIR-COOLED ENGINES ARE DESIGNED TO FIT THE JOB

AIR-COOLED



Modern air-cooled power to fit any job —1 to 35 H.P.



It's a railroad tie cutter and a sturdy, money saving piece of machinery, powered with a WISCONSIN 2 H.P. air-cooled engine.

Further Details on Request

HEAVY DUTY AIR COOLED ENGINES

WISCONSIN MOTOR CORPORATION

MILWAUKEE • WISCONSIN

POSITIONS

AVAILABLE OR WANTED

AVAILABLE—Electrical and Mechanical Product Development Engineer. Broad experience in engineering and manufacture of home devices. Electrical food preparing, cleaning, heating and thermostat-controlled appliances. Inventive type, knows tools and dies. Seeks contact with firm developing new products. Address Box 125, MACHINE DESIGN, Penton Building, Cleveland, Ohio.

CLASSIFIED advertisements are set in eight point Stymie bold face type, approximately eight words to a line. Rates are as follows:

Positions Available—20c a word, with a minimum charge of $10.00, which permits the use of fifty words.

Positions Wanted—10c a word, with a minimum charge of $3.00, which permits the use of thirty words.

The box number will be counted as one line or eight words.

Provides speeds slower than the second hand on your watch!

SPEEDS TO 0.6 RPM—TORQUES TO 350 IN-LB

The new Bodine 30RJ double worm speed reducer motors provide very slow speeds with relatively high torques. Reduction ratios of 72:1 to 2880:1 offer a wide range of speeds and torques. These motors are available in any of nine standard windings. Quiet, efficient operation is assured by the hardened steel worms and bakelite and bronze gears. Ball bearings and positive lubrication provide long trouble-free life and reduce friction. Bodine also makes a full line of fractional horsepower motors with and without reducers. Investigate Bodine motors for your products.

Flange-mounted 30RJ motor with vertical shaft.

Send for Catalog Sheet

BODINE

Bodine Electric Company
2258 W. Ohio St., Chicago, Illinois

Name_____

Company_____

Address_____

BODINE MOTORS

ENGINEERED FOR YOUR PRODUCT

NEW MACHINES—
And the Companies Behind Them

(For illustrations of other outstanding machinery see Pages 50-51)

Air Conditioning

Compressor, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Economizer units and sectional dehumidifier, York Ice Machinery Corp., York, Pa.
Heating and cooling unit, C. A. Dunham Co., Chicago.
Heat driver, Florence Stove Co., Gardner, Mass.

Business

Scale, The Exact Weight Scale Co., Columbus, O.

Dairy

Milk evaporator, Buffalo Foundry & Machine Co., Buffalo, N. Y.
Milk vending machine, Beverage Vending Machines Inc., Kansas City, Mo.
Stainless steel heater-cooler, Chester Dairy Supply Co., Chester, Pa.
Jug filler and capper, Specialty Brass Co., Kenosha, Wis.
Viscolizer, Cherry Burrell Corp., Chicago.

Domestic

Refrigerator-range, Frigidaire Div., General Motors Sales Corp., Dayton, O.
Healthifier, Michiana Products Corp., Michigan City, Ind.
Clipper, Andis Clipper Co., Racine, Wis.
Bed-lamp radio, Mitchell Mfg. Co., Chicago.
Oil burner, General Electric Co., Schenectady, N. Y.
Home elevator, Service Caster & Truck Co., Somerville, Mass.

Materials Handling

Industrial tractor, Allis-Chalmers Mfg. Co., Milwaukee.

Metalworking

Heater, American Car & Foundry Co., New York.
Press brake, Dreis & Krump Mfg. Co., Chicago.
Surface grinder, Continental Machines Inc., Minneapolis.
Hobbing machine, Barber-Colman Co., Rockford, Ill.
Electric drill, Independent Pneumatic Tool Co., Chicago.
Press brake, Verson Allsteel Press Co., Chicago.
Crankshaft lathe, Wickes Bros., Saginaw, Mich.
Buffing and polishing machine, The Hisey-Wolf Machine Co., Cincinnati.
Pipe threading machine, Beaver Pipe Tools, Warren, O.
Turret lathe, Warner & Swasey Co., Cleveland.
Polishing and buffing lathe, Rome Machinery Sales & Engrg. Co., Rome, N. Y.

Mining

Coal breaker, Pennsylvania Crusher Co., Philadelphia, Pa.
Earth movers, Caterpillar Tractor Co., Peoria, Ill.

Perforating

Hole piercing machine, Automatic Winding Co., Inc., E. Newark, N. J.

Petroleum

Unit pumpers, National Supply Co., Toledo, O.

Printing

Bronzer, Christensen Machine Co., Racine, Wis.
Intertype, Intertype Corp., Brooklyn.

Restaurant

Glass washer, Lofstrand Co., Washington.

Rubber

Straining machine, John Royle & Sons, Paterson, N. J.
Twin-cylinder tuber, National-Erie Corp., Erie, Pa.
Strainer, National Rubber Machinery Co., Akron, O.

Textile

Blending feeder, Lummus Cotton Gin Co., New York.
Selvage trimmer, Hermas Machine Co. Inc., Hawthorne, N. J.
Winder and twister, Fletcher Works Inc., Philadelphia.
Folder, American Laundry Machine Co., Rochester Engrg. & Centrifugal Div., Cincinnati.
Sewing machine, Singer Sewing Machine Co., New York.
Cutting machine, Taylor-Stiles & Co., Riegelville, N. J.
Twister, Atwood Machine Co., Stonington, Conn.
Singeing machine, Birch Bros. Inc., Somerville, Mass.
Double lock links machine, Queens Machine Corp., Brooklyn.

Welding

Spot welder, Pier Equipment Mfg. Co., Benton Harbor, Mich.
Seam welder, Expert Welding Machine Co., Detroit.
Electronic welder, Allis-Chalmers Mfg. Co., Milwaukee.
Electric arc-welder, Harnischfeger Corp., Milwaukee.
Welder for belt or direct drive, Lincoln Electric Co., Cleveland.
Arc-welder, The Hobart Brothers Co., Troy, O.
Remote control welder, Sterling Products Co., Los Angeles.

Woodworking

Portable electric sander, Sterling Products Co., Detroit.
Miter box, De Walt Products Corp., Lancaster, Pa.

SAVINGS in CLEARANCE MATERIAL WEIGHT COST

by using... **UNBRAKO**

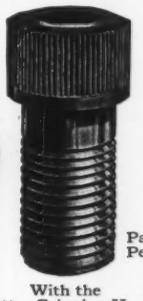
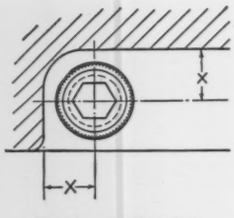


Fig. 1434 Pats. Pend.

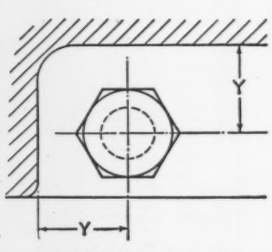
KNURLED
SOCKET HEAD CAP SCREWS
With the "Better Gripping Head"

More Compact Designs

These plan views clearly show how close to the corner the "Unbrako" can be placed compared with the placement of ordinary screws which require setting back to allow for hex head and wrench.



See how the Knurled "Unbrako" snuggles right into the corner.



Notice the great open spaces necessary for the hex head and wrench.

Reducing flange sizes without sacrificing strength is easily accomplished by using "Unbrako" Knurled Socket Head Cap Screws. They permit a compactness of design—illustrated at the left—which means decided savings plus greater neatness. It means extra holding power too, by bringing the screw head closer to the joint.

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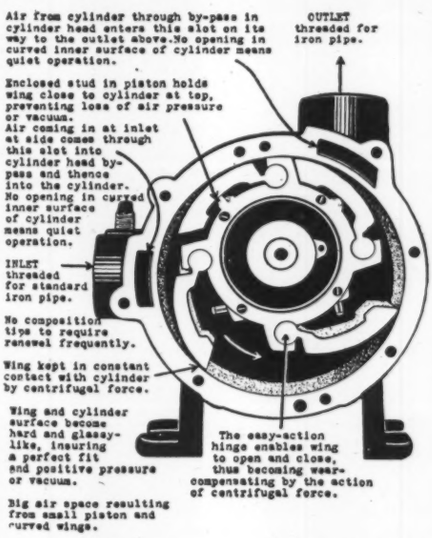
Air from cylinder through by-pass in cylinder head enters this slot on its way to the outlet above. No opening in curved inner surface of cylinder means quiet operation.
OUTLET threaded for iron pipe.
Enclosed stud in piston holds wing close to cylinder at top, preventing loss of air pressure or vacuum.
Air coming in at inlet at side comes through this slot into cylinder head by-pass and thence into the cylinder. No opening in curved inner surface of cylinder means quiet operation.
INLET threaded for standard iron pipe.
No composition tips to require renewal frequently.
Wing kept in constant contact with cylinder by centrifugal force.
Wing and cylinder surface become hard and glassy-like, insuring a perfect fit and positive pressure or vacuum.
Big air space resulting from small piston and curved wings.
The easy-action hinge enables wing to open and close, thus becoming wear-compensating by the action of centrifugal force.

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Perfect control of mechanisms of all kinds is just a matter of course when TRU-LAY Push-Pull Controls are used.

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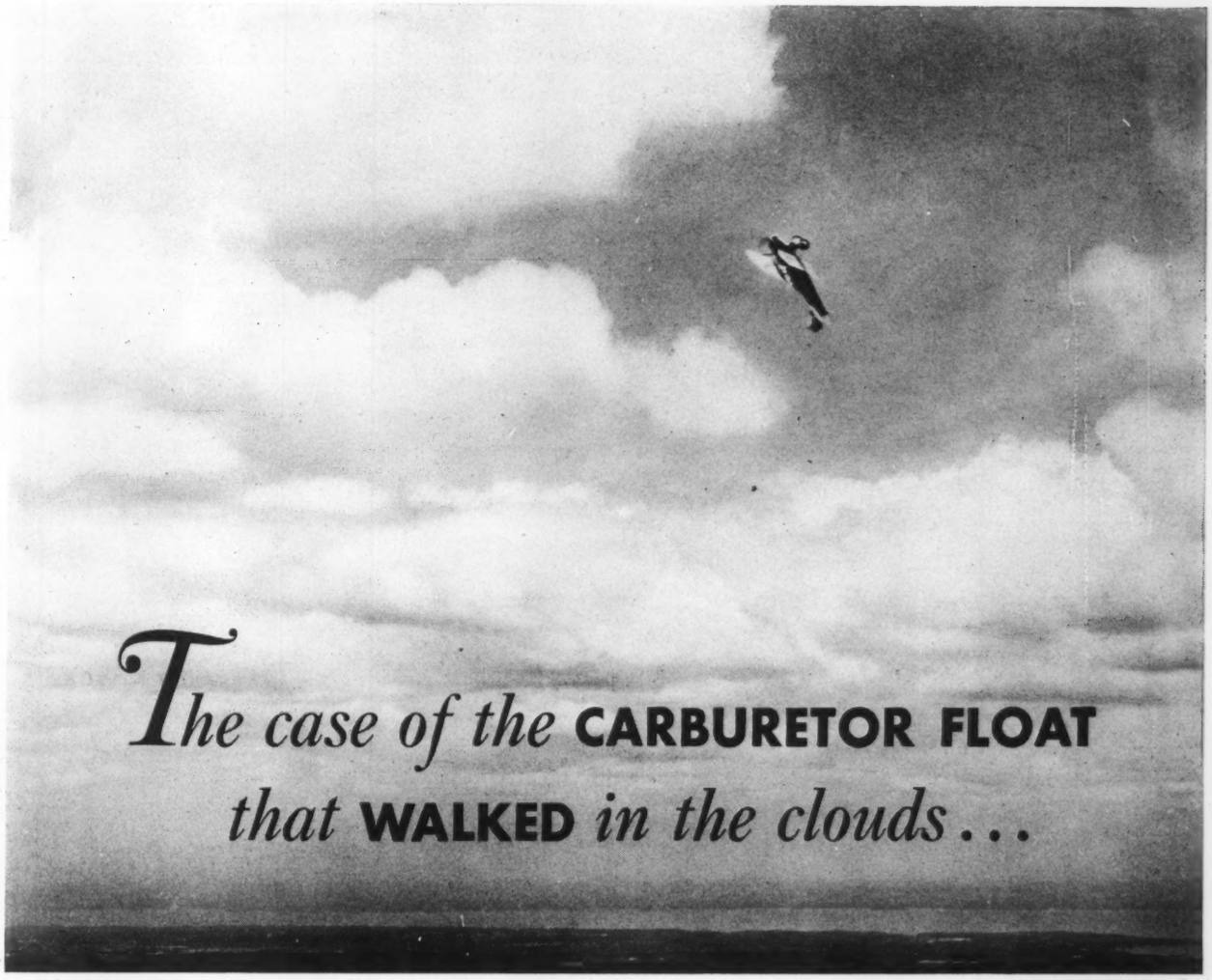


The case of the **CARBURETOR FLOAT** *that* **WALKED** *in the clouds . . .*

Fairchild Aerial Surveys, Inc.

HOW HOLLEY CARBURETOR ANSWERS AIRCRAFT NEED WITH DIAPHRAGMS OF DU PONT NEOPRENE

THIS pilot wasn't exactly nervous. But every time he slow-rolled his ship, the engine would start cutting out. Ten seconds on her back and the engine was dead.

His trouble was simple enough. On any ship the carburetor float valve would "walk away" from its seat in violent stunting.

He knew this "cutting out" was eliminated only by an elaborate two-carburetor system. But he wanted something better.

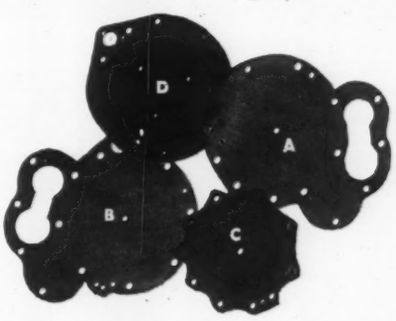
So a Holley engineer designed for him a carburetor *independent of gravity*. It was a new diaphragm assembly . . . with no floats to "walk away." Variable venturi replaced conventional fixed venturi.

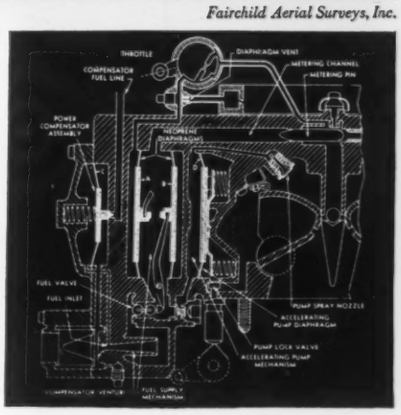
It was a sweet little job . . . but it still had a bug. Where was a strong, flexible diaphragm material resistant to aviation gasoline? Every material failed to meet such exacting requirements . . . until he tried neoprene-impregnated fabric.

Then tests showed the diaphragms were right. He had it . . . the audacious Holley Carburetor, made possible by neoprene's unique resistance to airplane fuels.

The carburetor is now widely used. The neoprene diaphragms are *delivering* . . . in day in, day out contact with aviation gasoline.

Neoprene is Du Pont's remarkable chemical rubber. It has the strength, resilience and toughness of natural rubber—but far more resistance to oils, gasoline, heat, ozone, aging and corrosive acids or gases.





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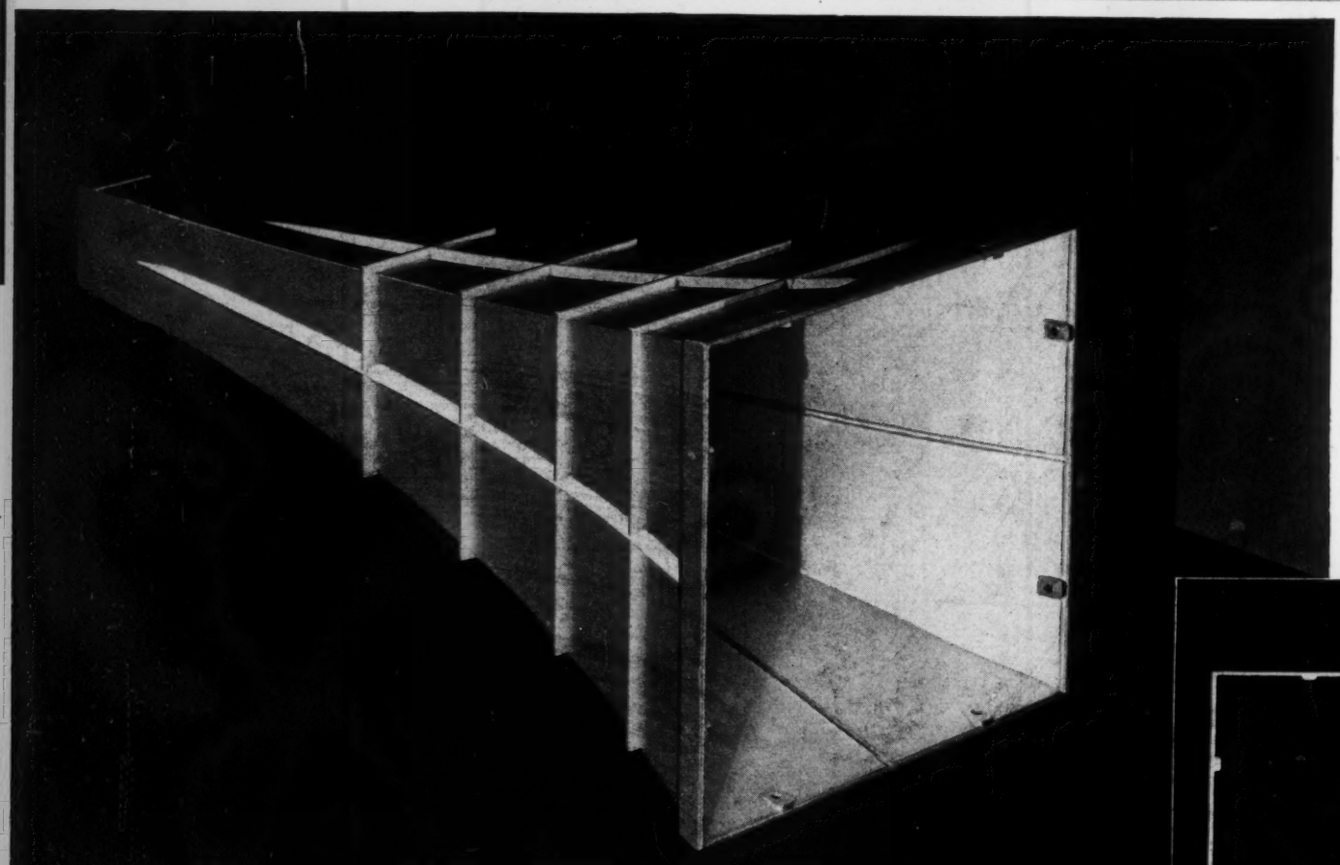

ACCURACY

—In A 20" Span

This is a loud speaker horn for a public address system. It is produced as a ZINC Alloy Die Casting for the reasons outlined below, among others.

1. ACCURACY—It is absolutely essential that this part be accurately shaped—and smooth surfaced—to form a perfect acoustical path. As a ZINC Alloy Die Casting, the important dimensions are held within plus or minus 0.002 in.—0.030 in. limit for the overall 20 in. length.

2. RIGIDITY—The acoustical factor also demands that the horn be of sufficient stiffness to maintain its shape in service. With a section thickness of approximately 0.065 in., the die casting easily meets this requirement—although subjected to considerable abuse. (Note the use of strengthening ribs).

3. LOW RESONANCE—The choice of material was extremely important in this application. Properly designed ZINC Alloy Die Castings have a quality of low resonance which makes them adaptable for use in sound carrying equipment.

4. ECONOMY—The only machining required on this part is the drilling of some small holes. And, being of one-piece construction, assembly costs are eliminated.

This application, like most others, has rather unusual requirements. But the ease with which ZINC Alloy Die Castings are solving production problems—in many industries—makes it imperative that you be well versed in this modern metal and method of fabrication. Consult any commercial die caster—or write to this Company for additional information.

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160 Front Street New York

The Research was done, the Alloys were developed, and most Die Castings are made wit

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